Supplemental Draft Environmental Impact Statement

Delta Wetlands Project

Prepared for:

US Army Corps of Engineers®
Sacramento District

Prepared by:

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May 2015

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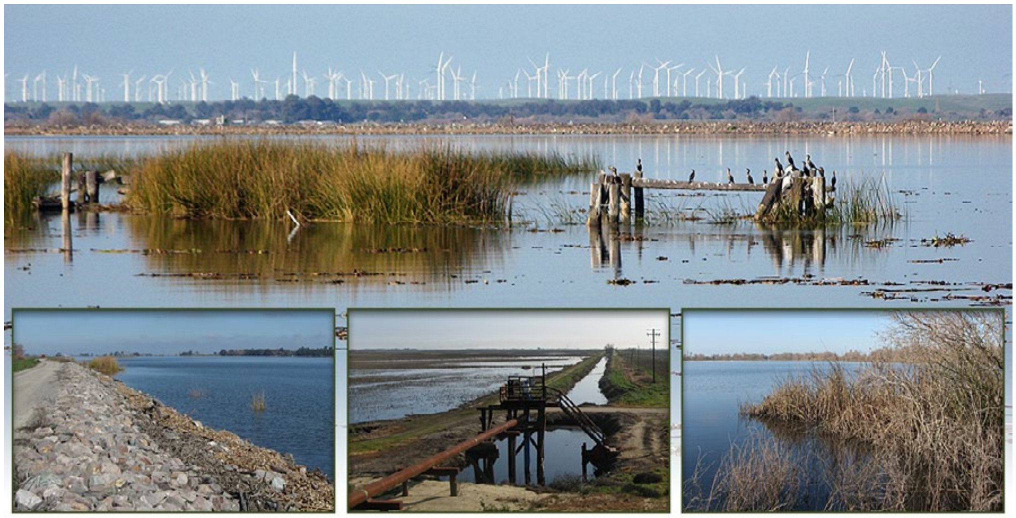

Prepared for:

Lead Agency

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Attention:

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SUPPLEMENTAL DRAFT ENVIRONMENTAL IMPACT STATEMENT

Delta Wetlands Project

San Joaquin and Contra Costa Counties, California

NEPA Lead Agency:
U.S. Army Corps of Engineers
Sacramento District Regulatory Branch

NEPA Cooperating Agencies:
U.S. Environmental Protection Agency

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Submit Comments to:
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Attention: Marc Fugler

ABSTRACT

This Supplemental Draft Environmental Impact Statement (SDEIS) documents the supplemental analysis of the potential effects of implementing each of four alternative scenarios for diversion and storage of water on two islands in the Sacramento-San Joaquin Delta (Delta) (i.e., Bacon Island and Webb Tract), and operation of a Compensatory Mitigation Plan on two other islands in the Delta (i.e., Bouldin Island and Holland Tract). Bacon Island and Bouldin Island are located in San Joaquin County while Holland Tract and Webb Tract are located in Contra Costa County, California. Places of use for the stored water supply consist of: (1) Semitropic Water Storage District in Kern County; (2) Metropolitan Water District of Southern California (which also includes Western Municipal Water District of Riverside County) in parts of Los Angeles, Orange, San Diego, Riverside, San Bernardino, and Ventura Counties; and (3) Golden State Water Company in portions of Los Angeles, Orange, San Bernardino, San Luis Obispo, Santa Barbara, and Ventura Counties. The project was previously evaluated in a Final Environmental Impact Statement prepared by the U.S. Army Corps of Engineers (USACE) in 2001. Delta Wetland Properties (the project applicant) has applied for a new USACE permit to fill approximately 2,156 acres of waters of the United States, including wetlands. USACE Sacramento District, as the NEPA lead agency, has determined that an SEIS should be prepared for the Delta Wetlands project because the previously-issued permit to discharge dredged or fill material into waters of the United States has expired. This abstract is provided in compliance with National Environmental Policy Act (NEPA) requirements. The SEIS documents the existing condition of environmental issues and resources in and around areas considered for water storage and use, and potential impacts on those issues and resources as a result of implementing the alternatives. The alternatives considered in detail are:

- **No-Action Alternative:** The proposed facilities would not be constructed, and the four project islands would continue to be used for intensive agricultural operations.

- **Alternative 1:** Differing from the Proposed Action only with regards to the operating criteria for diversion and discharge of stored water.

- **Alternative 2 (Proposed Action):** Water storage on two Reservoir Islands (Bacon Island and Webb Tract), and compensation for wetland and wildlife effects of the water storage operations on the Reservoir Islands by implementing a Compensatory Mitigation Plan on two Habitat Islands (Bouldin Island and Holland Tract). During periods of availability throughout the year, water would be diverted onto the Reservoir Islands to be

stored for later sale or release. Water would be discharged from the Reservoir Islands into Delta channels for sale for beneficial uses for export or for Bay Delta estuary needs during periods of demand throughout the year. Project water discharged into the Delta channels would mix with Delta inflows from the Sacramento and San Joaquin Rivers and other tributary rivers and would be available as either export water or Delta outflow.

- **Alternative 3:** All four islands would be used as water storage reservoirs with only a limited amount of compensation habitat provided on Bouldin Island.

The SDEIS for the Delta Wetlands project is available for a NEPA public comment and review period of 45 days from the date of publication of the notice of availability in the Federal Register. A copy can also be found on the Internet at http://www.spk.usace.army.mil/Missions/Regulatory/Permitting/EnvironmentalImpactStatements.aspx

Your written comments should be postmarked 45 days from the date of publication of the notice of availability in the Federal Register. The notice of availability is expected to be published in the Federal Register on May 29, 2015. Please submit and address your written comments on the SDEIS to the U.S. Army Corps of Engineers, Regulatory Branch, at the address noted above by July 13, 2015.

NOTE TO REVIEWERS

Reviewers should provide AECOM or USACE, the NEPA lead agency, with their comments during the review period of the SDEIS. This will enable USACE to analyze and respond to the comments at one time and to use the information acquired in preparation of the Final Supplemental Environmental Impact Statement (FSEIS), thus avoiding undue delay in the decision-making process. Reviewers have an obligation to structure their participation in the NEPA process so that it is meaningful and alerts the agency to reviewers' positions and contentions. *Vermont Yankee Power Corp. v. NRDC,* 435 U.S. 519, 533 (1978). Environmental objections that could have been raised at the draft stage may be waived if not raised until after completion of the FSEIS. *City of Angoon v. Hodel* (9th Circuit, 1986) and *Wisconsin Heritages, Inc. v. Harris,* 490 F. Supp. 1334, 1338 (E.D. Wis. 1980). Comments on the SDEIS should be specific and should address the adequacy of the statement and the merits of the alternatives discussed (40 CFR 1503.3).

EXECUTIVE SUMMARY

INTRODUCTION

This executive summary highlights the major areas of importance in the environmental analysis for the proposed Delta Wetlands Project, as required by 40 Code of Federal Regulations (CFR) Section 1502.12 of the National Environmental Policy Act (NEPA). As stated in NEPA Section 1502.12, "each environmental impact statement shall contain a summary which adequately and accurately summarizes the statement. The summary shall stress the major conclusions, areas of controversy (including issues raised by agencies and the public), and the issues to be resolved (including the choice among alternatives)." As required by NEPA regulations, this Executive Summary includes (1) a summary description of the Proposed Action, (2) a synopsis of environmental impacts and recommended mitigation measures (Table ES-1), (3) identification of the alternatives evaluated, and (4) a discussion of the areas of controversy associated with the project. For additional detail regarding specific issues, please consult Chapter 2, "Project Description and Alternatives"; Chapter 3, "Affected Environment and Environmental Consequences"; and Chapter 4, "Other Statutory Requirements."

LEAD AND COOPERATING AGENCIES

This document is supplemental draft environmental impact statement (SDEIS) prepared for the Delta Wetlands Project (the "Proposed Action" for purposes of NEPA).

The U.S. Army Corps of Engineers (USACE), Sacramento District, is the Federal lead agency under NEPA. The U.S. Environmental Protection Agency is a Cooperating Agency under NEPA.

Other local or regional agencies who may have jurisdiction over certain aspects of the project are listed in Chapter 1, "Introduction."

REQUESTED ENTITLEMENTS

The following entitlements are requested from the USACE for the project, and are discussed in detail in Chapter 2, "Project Description and Alternatives."

- A Department of the Army permit under Section 404 of the Clean Water Act for discharges into waters of the United States, a Section 10 permit under the Rivers and Harbors Act for activities within navigable waters;

- consultation for impacts on cultural resources pursuant to Section 106 of the National Historic Preservation Act; and

- Endangered Species Act Section 7 consultation leading to issuance of a biological opinion and possible incidental-take statement for activities affecting endangered species.

In addition to the authorizations and approvals requested from USACE, permits and other approval actions from the following Federal, state, regional, and local agencies may be required:

- U.S. Environmental Protection Agency
- U.S. Fish and Wildlife Service
- National Marine Fisheries Service
- California Department of Fish and Wildlife
- Central Valley Regional Water Quality Control Board
- California Office of Historic Preservation
- San Joaquin Valley Air Quality Management District
- Bay Area Air Quality Management District

PROJECT CHARACTERISTICS

PROJECT LOCATION

Bacon Island and Bouldin Island are located in San Joaquin County and Holland Tract and Webb Tract are located in Contra Costa County (see Exhibits 1-1a and 1-1b in Chapter 1, "Introduction"). Places of use of water supply consist of: (1) Semitropic Water Storage District in Kern County; (2) Metropolitan Water District of Southern California (which also includes Western Municipal Water District of Riverside County) in parts of Los Angeles, Orange, San Diego, Riverside, San Bernardino, and Ventura Counties; and (3) Golden State Water Company in portions of Los Angeles, Orange, San Bernardino, San Luis Obispo, Santa Barbara, and Ventura Counties (see Exhibits 1-2 through 1-6 in Chapter 1, "Introduction").

ELEMENTS OF THE PROJECT

The project is intended to increase the availability of high-quality water in the Sacramento-San Joaquin Delta (Delta) for export or outflow through the following six basic parts:

- diversion of water in the Delta;
- water storage on two Reservoir Islands (Bacon Island and Webb Tract);
- compensation for wetland and wildlife effects of the water storage operations on the Reservoir Islands by implementing a proposed Compensatory Mitigation Plan (CMP) on two Habitat Islands (Bouldin Island and Holland Tract);
- supplemental water storage in the Semitropic Groundwater Storage Bank and the Antelope Valley Water Bank south of the Delta;
- provision of water supply for designated south-of-Delta users; and
- release of water for water quality enhancement in the Bay-Delta Estuary in the fall as an additional beneficial water use in a designated place of use.

Additional details are contained in Chapter 1, "Introduction" and Chapter 2, "Project Description and Alternatives."

SUMMARY OF SIGNIFICANT AND POTENTIALLY SIGNIFICANT EFFECTS AND MITIGATION MEASURES

Table ES-1 displays a summary of significant and potentially significant effects and proposed mitigation measures that would avoid, eliminate, minimize, or reduce potential effects. In Table ES-1, each effect and its significance conclusion are followed by the mitigation requirement, and the level of significance of the effect following implementation of each mitigation measure is identified. For detailed descriptions of project effects and mitigation measures, please see Sections 3.1 through 3.19 in Chapter 3, "Affected Environment and Environmental Consequences."

ALTERNATIVES

The NEPA Council on Environmental Quality Regulations (40 CFR 15012.14) require that an EIS describe a range of reasonable alternatives to the proposed action that could feasibly attain the basic objectives of the project and avoid and/or lessen the environmental effects of the project. Chapter 2, "Project Description and

Alternatives," of this SEIS provides a more detailed discussion of the alternatives summarized below. A No-Action Alternative, as required under NEPA, is also part of the alternatives evaluated in this SEIS. A No USACE Permit Alternative is not evaluated in this SEIS because the project could not be implemented without a permit.

NO-ACTION ALTERNATIVE

The project applicant would implement intensive agricultural operations on the four project islands or sell the property to another entity that would likely implement intensive agriculture. The No-Action Alternative is based on the assumption that intensified agricultural conditions represent the most realistic scenario for the project islands if the project is not implemented. Changes in project island operations under the No-Action Alternative would be limited to those farming activities that increase cropping intensity and could be implemented without a permit issued by USACE or the State Water Resources Control Board. The No-Action Alternative would entail implementing more efficient drainage and weed management practices on Holland and Webb Tracts and shifting some crop types on Bacon and Bouldin Islands. Private hunting opportunities on the project islands already occur under existing conditions; under the No-Action Alternative, a more intensive for-fee hunting program would be operated on the project islands. The project applicant estimates that this intensified hunting program would create an additional 12,000 hunter-use days as compared to existing conditions. No new recreation facilities would be constructed on any of the project islands.

ALTERNATIVE 1

Alternative 1 differs from Alternative 2 (Proposed Action) only with regard to the operating criteria for diversion and discharge of stored water. Under Alternative 1, project discharges of water would be treated as additions to total Delta inflow. Export of project water discharged from the islands thus would be limited to the lesser of the permitted export pumping capacity and the amount calculated under the strict interpretation of the export limits (i.e., the "percent inflow" export limit), based on the adjusted inflow amount. Under Alternative 1, the project has two choices regarding allocation of discharges. If the project chooses to discharge at the maximum discharge rate, some of the releases must be used to increase Delta outflow while the balance is exported. Alternatively, the project could choose to limit discharges so that no allocation to Delta outflow is needed. No new recreation facilities would be constructed on any of the project islands.

ALTERNATIVE 2 (PROPOSED ACTION)

Bacon Island and Webb Tract would be managed as Reservoir Islands for water diversion, storage, and discharge. The project life-cycle for this use is planned for 50 years. Facilities needed for water storage operations consist of intake siphon stations with auxiliary pumps to divert water onto the Reservoir Islands and pump stations to discharge stored water from the islands. The Reservoir Islands have been designed for water storage levels up to a maximum elevation of +4 feet (National Geodetic Vertical Datum of 1929), providing a total estimated storage capacity of 215,000 acre feet, with 115,000 acre feet on Bacon Island and 100,000 acre feet on Webb Tract.

The project-related conversion to Reservoir Islands and Habitat Islands would include strengthening and maintaining 56 miles of levees. The interior of the levees on the Reservoir Islands would be improved to resist the stresses and erosion potential of wind-waves and water level drawdown. Levee design would control wave erosion through placement of rock revetment on the inside slopes of the perimeter levees. Project-related seepage would be controlled with a slurry wall and an extensive monitoring and shallow groundwater pumping system.

Bouldin Island and Holland Tract would be dedicated to and managed for wetlands and other wildlife habitat and vegetation. The primary function of the Habitat Islands is to offset effects of water storage operations on listed Threatened and Endangered species, and on waters of the United States (including wetlands) pursuant to Section 404 of the Clean Water Act, and to provide other enhanced and dedicated wildlife habitat areas for wintering waterfowl and support limited hunting opportunity. The Habitat Islands would be developed and managed to provide breeding and foraging habitat for special-status wildlife species and other important wildlife species groups.

The project would use existing irrigation water right licenses and riparian water rights to supply water for wetlands and wildlife habitat purposes on the Habitat Islands. The timing and volumes of diversions onto the Habitat Islands would depend on the needs of wetlands and wildlife habitat. Wetland diversions typically would begin in September, and water would be circulated through the winter months. The maximum rate of proposed diversions onto Holland Tract and Bouldin Island would be 200 cubic feet per second per island. Water likely would be applied to the Habitat Islands in most months for management of open water and perennial wetlands, flooded seasonal wetlands, and irrigated croplands (grown partially for wildlife food). Approximately 20,000 acre feet would be diverted annually onto the Habitat Islands, which is less than the current agricultural diversions of about 30,000 acre feet. No new recreation facilities would be constructed on any of the project islands.

ALTERNATIVE 3

All four project islands would be managed for year-round diversion and storage of water. This alternative represents the maximum water appropriations that would be achieved under all of the project's water right applications. This alternative also represents the maximum amount of water storage that would be feasible on the four project islands based on levee height and internal elevation. Project operations under this alternative would be the same as those described above for Alternative 2 with respect to diversion and discharge operations (except for diversion and discharge rates). However, this alternative would allow year-round water diversions on all four project islands and would require substantially greater investments in internal levee construction to protect State Route (SR) 12 on Bouldin Island.

Under Alternative 3, a habitat reserve (the North Bouldin Habitat Area) consisting of approximately 875 acres would be created north of SR 12 on Bouldin Island to compensate for some of the impacts associated with water storage operations. Additional off-site wildlife habitat and wetland compensation would be required for this alternative. The levees on the project islands would be improved as described above under Alternative 2; however, this alternative would also require construction of a large interior levee, that would be known as Wilkerson Dam, on Bouldin Island parallel to SR 12. No new recreation facilities would be constructed on any of the project islands.

KNOWN AREAS OF CONTROVERSY

NEPA regulations (40 CFR 1502.12) require that the summary of an EIS identify areas of controversy known to the lead agency, including issues raised by agencies and the public. During the public comment period for the notice of intent, comments were received from one member of the public expressing concern regarding the diversion of water in the Delta for storage and potential affects on downstream water users. A comment letter was also received from the U.S. Environmental Protection Agency expressing concerns related to loss of wetlands, water quality, aquatic resources, and development of the proposed CMP. In general, areas of potential controversy known to the USACE and the project applicant consist of agricultural resources, biological resources (aquatic and terrestrial, including wetlands), water quality, and water supply (including water rights). These issues were considered in the preparation of this SEIS and, where appropriate, are addressed in the environmental analyses presented in Chapters 3 and 4.

PUBLIC PARTICIPATION AND ADDITIONAL STEPS IN THE NEPA REVIEW PROCESS

This SEIS is being distributed to interested agencies, stakeholder organizations, and individuals. This distribution ensures that interested parties have an opportunity to express their views regarding the environmental effects of the project, and to ensure that information pertinent to permits, authorizations, and approvals is provided to decision makers for the lead agencies other interested agencies. This document is available for review by the public on the USACE Web site at http://www.spk.usace.army.mil/Missions/Regulatory/Permitting/Environmental ImpactStatements.aspx. The SEIS is being distributed for a 45-day period that will end on July 13, 2015; however, USACE will continue to accept comments on the SDEIS until the ROD is issued. Comments should be sent to the following addresses:

Marc Fugler
U.S. Army Corps of Engineers, Regulatory Branch
1325 J Street, Room 1350
Sacramento, CA 95814-2922
E-mail: Marc.A.Fugler@usace.army.mil

If comments are provided via e-mail, please include the project title in the subject line, attach comments in MS Word format, and include the commenter's U.S. Postal Service mailing address.

A public meeting on the SDEIS will be conducted by USACE on June 10, 2015 from 4 to 7 p.m. at the Tsakopoulos Galleria, 828 I St, Sacramento, California. Comments on the SDEIS may be provided during the public meeting, and written comments may also be provided at any time during the comment period as described above.

Once all comments have been assembled and reviewed, responses will be prepared to address significant environmental issues that have been raised in the comments. The responses will be included in a final SEIS.

Table ES-1
Summary of Effects and Mitigation Measures

Effect	Significance
Mitigation	
3.1 AESTHETICS	
VIS-1: Reduction in the Quality of Views of Bacon Island and Webb Tract Interiors from Island Levees.	
NAA: Intensified agricultural uses would reduce the visual quality on the Reservoir Island interiors, but there are low numbers of sensitive viewers.	LTS
A1, A2, A3: Project implementation would reduce visual quality on the Reservoir Island interiors, but there are low numbers of sensitive viewers.	LTS
NAA: No mitigation is required.	
A1, A2, A3: No mitigation is required.	
VIS-2: Potential Conflict with Local Scenic Designation for Bacon Island Road.	
NAA: No new facilities would be constructed in the viewshed of Bacon Island Road.	NE
A1, A2, A3: Project implementation would introduce a siphon station facility and would remove levee vegetation on Bacon Island; however, this would not result in a substantial adverse effect on the local scenic designation.	LTS
NAA: No mitigation is required.	
A1, A2, A3: No mitigation is required.	
VIS-3: Reduction in the Quality of Views of Bacon Island and Webb Tract from Adjacent Waterways and from the Santa Fe Railways Amtrak Line.	
NAA: The No-Action Alternative would not substantially change views of Reservoir Island levees from adjacent waterways or from the Santa Fe Railways Amtrak Line.	LTS
A1, A2: Project implementation would change views of Reservoir Island levees from adjacent waterways and from the Santa Fe Railways Amtrak Line for high numbers of sensitive viewers.	S
A3: Project implementation would change views of Reservoir Island levees from adjacent waterways for high numbers of sensitive viewers.	S

NAA (No-Action Alternative) A1 (Alternative 1) A2 (Alternative 2) A3 (Alternative 3) B (Beneficial)
NE (No effect) LTS (Less than significant) PS (Potentially significant) S (Significant) SU (Significant and unavoidable)

Table ES-1
Summary of Effects and Mitigation Measures

Effect	Significance
Mitigation	
NAA: No mitigation is required. **A1, A2, A3: Mitigation Measure VIS-MM-1: Partially Screen Proposed Pump and Siphon Stations from Important Viewing Areas.** The project applicant will, consistent with flood control and levee or facility maintenance requirements, establish screening that could consist of native trees, shrubs, landscape berms, and ground covers between the project facilities and designated scenic waterways. The project applicant will implement landscape berms near structures to provide partial screening and better connect the buildings visually to the site and the area. Screening vegetation will be planted in locations and at a density that will provide at least a 50% visual screen after 5 years. **Mitigation Measure VIS-MM-2: Design Levee Improvements, Siphon and Pump Stations, and Maintenance Boat Docks to Be Consistent with the Surrounding Landscape.** The project applicant will require that pump and siphon station structures be painted in earth tones to blend with the surrounding landscape. Rock revetment material will be selected to blend with the surrounding landscape. The project applicant will limit structure heights and emphasize horizontal features in its design. Boat docks and related structures necessary for maintenance of project facilities will be constructed of natural-appearing materials with subdued, earth-toned colors to blend in with the surrounding environment. ***Significance after Mitigation: significant and unavoidable*** ***Cumulatively significant and unavoidable***	
VIS-4: Change in Bouldin Island Views from State Route 12.	
NAA: The No-Action Alternative would not change views of Bouldin Island from SR 12.	NE
A1, A2: Management of Bouldin Island for wildlife would enhance views.	B, LTS
A3: Construction of a new levee parallel to SR 12 on Bouldin Island would alter the viewshed.	LTS
NAA: No mitigation is required. **A1, A2, A3:** No mitigation is required.	
VIS-5: Reduction in the Quality of Views of the Habitat Islands from Adjacent Waterways.	
NAA: Because no new water storage facilities would be constructed on the project islands, there would be no effect on the visual quality from locally-designated scenic waterways.	NE
A1, A2: Management of Bouldin Island and Holland Tract for habitat preservation would not reduce the visual quality from locally designated scenic waterways.	LTS

NAA (No-Action Alternative) A1 (Alternative 1) A2 (Alternative 2) A3 (Alternative 3) B (Beneficial)
NE (No effect) LTS (Less than significant) PS (Potentially significant) S (Significant) SU (Significant and unavoidable)

Table ES-1
Summary of Effects and Mitigation Measures

Effect		Significance
Mitigation		
A3:	Construction of proposed water storage facilities on Bouldin Island and Holland Tract would reduce the visual quality from locally designated scenic waterways.	S
NAA: No mitigation is required. **A1, A2:** No mitigation is required. **A3: Implement Mitigation Measures VIS-MM-1 and VIS-MM-2**. ***Significance after Mitigation: significant and unavoidable*** ***Cumulatively significant and unavoidable***		
VIS-6: Increase in Opportunities for Recreation Facility Members to View Island Interiors and Other Areas in the Project Vicinity.		
NAA:	The proposed intensive for-fee hunting program would result in increased viewing opportunities and enhanced vividness of views of the Habitat Island interiors.	LTS
A1, A2, A3:	No new recreation facilities would be constructed. Existing recreation opportunities provide views of the project islands and vicinity.	NE
NAA: No mitigation is required. **A1, A2, A3:** No mitigation is required.		
3.2 AGRICULTURAL RESOURCES		
AG-1: Consistency with Williamson Act Contracts.		
NAA:	There are no Williamson Act Contracts on any of the four project islands.	NE
A1, A2:	There are no Williamson Act Contracts on any of the four project islands.	NE
A3:	There are currently no Williamson Act Contracts on any of the four project islands.	NE
NAA: No mitigation is required. **A1, A2, A3:** No mitigation is required.		

NAA (No-Action Alternative) A1 (Alternative 1) A2 (Alternative 2) A3 (Alternative 3) B (Beneficial)
NE (No effect) LTS (Less than significant) PS (Potentially significant) S (Significant) SU (Significant and unavoidable)

Table ES-1
Summary of Effects and Mitigation Measures

Effect	Significance
Mitigation	
AG-2: Conversion of Prime Farmland and Other Agricultural Land to Nonfarm Uses.	
NAA: Under the No-Action Alternative, no existing agricultural land would be converted to nonfarm uses.	NE
A1, A2, A3: The project would cause large amounts of existing agricultural land to be converted to nonfarm uses.	S
NAA: No mitigation is required.	
A1, A2, A3: Mitigation Measure AG-MM-1: Provide Funding to Semitropic to Further District Goals of Sustaining Agriculture. During each of the first 10 years of the project operations, the project applicant will provide to the Semitropic Water Storage District $500,000, for a total of $5,000,000. The funding is intended to further Semitropic's goals of sustaining agriculture through the provision of agricultural surface water to farmers within its boundaries at least cost and provide long-term reliability. It would be used for the following purposes: ▸ Purchase of voluntary conservation easements over Prime Farmland in Semitropic's District. ▸ Purchase of imported water by Semitropic. ▸ Development and operation of infrastructure needed to deliver water to and within Semitropic. ▸ Other purposes consistent with the Semitropic's mission. This mitigation measure is consistent with Semitropic's authority and does not obligate it to undertake extraterritorial condemnation measures. ***Significance after Mitigation: significant and unavoidable*** ***Cumulatively significant and unavoidable***	
3.3 AIR QUALITY	
AIR-1: Increase in CO Emissions on the Project Islands During Construction.	
NAA: No construction activities would occur as part of the No-Action Alternative. Thus, there would be no construction-related increase in CO.	NE
A1, A2: The project's construction-related activities could generate temporary and short-term CO emissions that exceed applicable mass emission thresholds.	LTS
A3: The project's construction-related activities would generate temporary and short-term CO emissions that exceed applicable mass emission thresholds.	LTS
NAA: No mitigation is required.	
A1, A2, A3: Mitigation Measure AIR-MM-1: Perform Routine Maintenance of Construction Equipment. During construction under Alternatives 1 and 2, the primary source of CO emissions and other pollutants, including ROG and NO_X, is the exhaust generated by earthmoving equipment and other construction and	

NAA (No-Action Alternative) A1 (Alternative 1) A2 (Alternative 2) A3 (Alternative 3) B (Beneficial)
NE (No effect) LTS (Less than significant) PS (Potentially significant) S (Significant) SU (Significant and unavoidable)

Table ES-1
Summary of Effects and Mitigation Measures

Effect	Significance
Mitigation	
transport vehicles. Therefore, construction crews will perform routine maintenance of earthmoving equipment, as well as all other construction and transport vehicles. Routine maintenance involves oil changes and tune-ups performed at least as frequently as recommended by the manufacturers. This measure will be included as a condition of the construction contract and will be enforced by the project applicant through weekly inspection by the construction inspector. **Mitigation Measure AIR-MM-2: Choose Borrow Sites Close to Fill Locations.** Construction crews will take borrow material from appropriate sites located closest to intended fill locations. This measure would reduce the overall amount of equipment and vehicle operation, thereby reducing exhaust emissions of CO and other pollutants, including ROG, NO_X, and PM_{10}. This measure also would reduce the amount of PM_{10} emitted into the air by vehicles traveling over unpaved or dusty surfaces, the main source of PM_{10} emissions during construction. This measure will be included as a condition of the construction contract and will be enforced by the project applicant through weekly inspection by the construction inspector. **Mitigation Measure AIR-MM-3: Prohibit Unnecessary Idling of Construction Equipment Engines.** Construction crews will be prohibited from leaving construction equipment or other vehicle engines idling when not in use for more than 5 minutes. This measure would reduce the amount of CO and other pollutants, including ROG, NO_X, and PM_{10}, emitted in engine exhaust. This measure will be included as a condition of the construction contract and will be enforced by the project applicant through weekly inspection by the construction inspector. ***Significance after Mitigation: less than significant*** ***Cumulatively considerable and unavoidable***	
AIR-2: Increase in CO Emissions on the Project Islands During Operation.	
NAA: The increased intensity of agricultural activities and for-fee hunting program could generate CO emissions that exceed applicable mass emission thresholds.	LTS
A1, A2, A3: Following construction of the project, long-term operational activities would generate CO emissions that exceed applicable mass emissions thresholds.	LTS
NAA: No mitigation is required. **A1, A2, A3:** No mitigation is required.	
AIR-3: Increase in ROG Emissions on the Project Islands During Construction.	
NAA: No construction activities would occur as part of the No-Action Alternative. Thus, there would be no construction-related increase in ROG emissions.	NE
A1, A2, A3: The project's construction-related activities would generate temporary and short-term ozone precursor ROG emissions that exceed applicable mass emission thresholds.	S

NAA (No-Action Alternative) A1 (Alternative 1) A2 (Alternative 2) A3 (Alternative 3) B (Beneficial)
NE (No effect) LTS (Less than significant) PS (Potentially significant) S (Significant) SU (Significant and unavoidable)

Table ES-1
Summary of Effects and Mitigation Measures

Effect	Significance
Mitigation	
NAA: No mitigation is required. **A1, A2, A3: Implement Mitigation Measures AIR-MM-1, AIR-MM-2, and AIR-MM-3** ***Significance after Mitigation: significant and unavoidable*** ***Cumulatively considerable and unavoidable***	
AIR-4: Increase in ROG Emissions on the Project Islands During Operation.	
NAA: Increased intensity of agricultural operations and the for-fee hunting program could generate ozone precursor ROG emissions that exceed applicable mass emissions thresholds.	LTS
A1, A2, A3: Following construction of the project, long-term operational activities would not generate ozone precursor ROG emissions that exceed applicable mass emissions thresholds.	LTS
NAA: No mitigation is required. **A1, A2, A3:** No mitigation is required.	
AIR-5: Increase in NO_X Emissions on the Project Islands During Construction.	
NAA: No construction activities would occur as part of the No-Action Alternative. Thus, there would be no construction-related increase in NO_x emissions.	NE
A1, A2, A3: The project's construction-related activities would generate temporary and short-term ozone precursor NO_X emissions that exceed applicable mass emission thresholds.	S
NAA: No mitigation is required. **A1, A2, A3: Implement Mitigation Measures AIR-MM-1, AIR-MM-2, and AIR-MM-3** ***Significance after Mitigation: significant and unavoidable*** ***Cumulatively considerable and unavoidable***	
AIR-6: Increase in NO_X Emissions on the Project Islands During Operation.	
NAA: Increased intensity of agricultural operations and the for-fee hunting program could generate NO_X emissions that exceed applicable mass emissions thresholds.	LTS
A1, A2, Following construction of the project, long-term operational activities would generate ozone precursor NO_X emissions that exceed	S

Table ES-1
Summary of Effects and Mitigation Measures

Effect	Significance
Mitigation	
A3: applicable mass emissions thresholds.	
NAA: No mitigation is required.	
NAA: No mitigation is required. **A1, A2, A3: Mitigation Measure AIR-MM-4: Coordinate with the SJVAPCD and BAAQMD to Reduce or Offset Emissions.** The project applicant will coordinate with the SJVAPCD and the BAAQMD to implement measures to reduce or offset ROG and NO_X emissions of the project operations. These measures may include implementing a voluntary emission reduction agreement (VERA). The SJVAPCD has encouraged use of a VERA as a means to reduce project emissions. **Mitigation Measure AIR-MM-5: Use Electrically-Powered Pumps in Lieu of Diesel-Powered Pumps.** In the event that Mitigation Measure AIR-MM-4 is not sufficient to fully reduce emissions to a less-than-significant level, electrically-powered pumps will be used in lieu of diesel-powered pumps, which would reduce the increase in operational NO_X emissions to less than the daily and annual significance thresholds. ***Significance after Mitigation: less than significant*** ***Cumulatively considerable and unavoidable***	
AIR-7: Increase in PM_{10} Emissions on the Project Islands During Construction.	
NAA: No construction activities would occur as part of the No-Action Alternative. Thus, there would be no construction-related increase in PM_{10} emissions.	NE
A1, A2, A3: The project's construction-related activities would generate temporary and short-term PM_{10} emissions that exceed applicable mass emission thresholds.	S
NAA: No mitigation is required. **A1, A2, A3: Mitigation Measure AIR-MM-6: Implement Construction Practices that Reduce Generation of Particulate Matter.** The project applicant will require construction crews to implement the following measures throughout the construction period to reduce generation of particulate matter in the vicinity of construction sites: ▸ All exposed surfaces (e.g., parking areas, staging areas, soil piles, graded areas, and unpaved access roads) will be watered two times per day. ▸ All haul trucks transporting soil, sand, or other loose material off-site will be covered. ▸ All visible mud or dirt track-out onto adjacent public roads will be removed using wet power vacuum street sweepers at least once per day. The use of dry power sweeping is prohibited. ▸ All vehicle speeds on unpaved roads will be limited to 15 mph. ▸ Idling times will be minimized either by shutting equipment off when not in use or reducing the maximum idling time to 5 minutes (as required by the California airborne toxics control measure Title 13, Section 2485 of California Code of Regulations). Clear signage will be provided for construction workers at all access	

NAA (No-Action Alternative) A1 (Alternative 1) A2 (Alternative 2) A3 (Alternative 3) B (Beneficial)
NE (No effect) LTS (Less than significant) PS (Potentially significant) S (Significant) SU (Significant and unavoidable)

Table ES-1
Summary of Effects and Mitigation Measures

Effect	Significance
Mitigation	

points.

- All construction equipment will be maintained and properly tuned in accordance with manufacturer's specifications. All equipment will be checked by a certified visible emissions evaluator.
- Post a publicly visible sign at the soil transfer site within the BAAQMD with the telephone number and person to contact at the lead agency regarding dust complaints. This person will respond and take corrective action within 48 hours. The BAAQMD's phone number will also be visible to ensure compliance with applicable regulations. Pave, apply water three times daily, or apply soil stabilizers on all unpaved access roads, parking areas, and staging areas at construction sites.
- All exposed surfaces will be watered at a frequency adequate to maintain minimum soil moisture of 12%. Moisture content can be verified by lab samples or moisture probe.
- All excavation, grading, and/or demolition activities will be suspended when average wind speeds exceed 20 mph.
- Wind breaks (e.g., trees, fences) will be installed on the windward side(s) of actively disturbed areas of construction. Wind breaks should have at maximum 50% air porosity.
- Vegetative ground cover (e.g., fast-germinating native grass seed) will be planted in disturbed areas as soon as possible and watered appropriately until vegetation is established.
- The simultaneous occurrence of excavation, grading, and ground-disturbing construction activities on the same area at any one time will be limited. Activities will be phased to reduce the amount of disturbed surfaces at any one time.
- All trucks and equipment, including their tires, will be washed off prior to leaving the site.
- Site accesses to a distance of 100 feet from the paved road will be treated with a 6 to 12 inch compacted layer of wood chips, mulch, or gravel.
- Sandbags or other erosion control measures will be installed to prevent silt runoff to public roadways from sites with a slope greater than 1%.
- Minimize the idling time of diesel-powered construction equipment to 2 minutes.
- Develop a plan demonstrating that the off-road equipment (more than 50 horsepower) to be used will achieve a project-wide fleet-average 20% NO_x reduction and 45% PM reduction, compared to the most recent ARB fleet average. Acceptable options for reducing emissions will include the use of late model engines, low-emission diesel products, alternative fuels, engine retrofit technology, after-treatment products, add-on devices such as particulate filters, and/or other options, as they become available.
- Use low volatile organic compounds (i.e., ROG) coatings beyond local requirements (i.e., Regulation 8, Rule 3: Architectural Coatings).
- Require all construction equipment, diesel trucks, and generators be equipped with Best Available Control Technology for emission reductions of NO_x and PM.
- Require all contractors use equipment that meets ARB's most recent certification standard for off-road heavy duty diesel engines.

These measures will be included as a condition of the construction contract and will be enforced through weekly inspection by the project applicant.

Significance after Mitigation: less than significant

NAA (No-Action Alternative)	A1 (Alternative 1)	A2 (Alternative 2)	A3 (Alternative 3)	B (Beneficial)
NE (No effect)	LTS (Less than significant)	PS (Potentially significant)	S (Significant)	SU (Significant and unavoidable)

Table ES-1
Summary of Effects and Mitigation Measures

Effect		Significance
Mitigation		
AIR-8: Increase in PM_{10} Emissions on the Project Islands During Operation.		
NAA:	Increased intensity of agricultural operations and the for-fee hunting program could generate PM_{10} emissions that exceed applicable mass emissions thresholds.	LTS
A1, A2, A3:	Following construction of the project, long-term operational activities would not generate PM_{10} emissions that exceed applicable mass emissions thresholds.	LTS
NAA: No mitigation is required. **A1, A2, A3:** No mitigation is required.		
AIR-9: Need for Conformity Analysis and Conflicts with Federal Attainment Planning.		
NAA:	Agricultural activities are not subject to Federal air quality standards for criteria air pollutants, therefore a conformity analysis is not required.	NE
A1, A2, A3:	Project implementation could conflict with attainment and implementation planning efforts related to Federal air quality standards for criteria air pollutants; therefore, a Federal conformity analysis would be required.	S
NAA: No mitigation is required. **A1, A2, A3: Implement Mitigation Measures AIR-MM-1, AIR-MM-2, AIR-MM-3, AIR-MM-4, AIR-MM-5, and AIR-MM-6** ***Significance after Mitigation: significant and unavoidable*** ***Cumulatively considerable and unavoidable***		
3.4 AQUATIC RESOURCES		
AQR-1: Alteration of Fish Habitat through Construction of Project Facilities.		
NAA:	No new facilities would be constructed and no existing facilities would be altered or expanded in Delta waterways.	NE
A1, A2:	Construction of proposed intake facilities and fish screens, discharge facilities, and maintenance boat docks could adversely change spawning and rearing habitat used by Delta fish species resulting in habitat loss.	S
A3:	Construction of intake facilities and fish screens, discharge facilities, and maintenance boat docks on the Reservoir Islands could adversely change spawning and rearing habitat used by Delta fish species, resulting in habitat loss.	S

NAA (No-Action Alternative) A1 (Alternative 1) A2 (Alternative 2) A3 (Alternative 3) B (Beneficial)
NE (No effect) LTS (Less than significant) PS (Potentially significant) S (Significant) SU (Significant and unavoidable)

Table ES-1
Summary of Effects and Mitigation Measures

Effect	Significance
Mitigation	
NAA: No mitigation is required. **A1, A2, A3: Mitigation Measure AQR-MM-1: Minimize Effects to Shallow-Water Vegetated Habitat and Replace Habitat Loss at a Ratio of 3:1.** The project applicant will design the project to minimize effects to shallow-water vegetated habitat. The project applicant will replace habitat lost due to construction of project facilities at a preservation ratio of 3:1. The acreage replaced will be determined based upon the final construction footprint acreage. The replacement will consist of the preservation of tidal habitat owned by the project applicant at Chipps Island, which will be placed into a conservation easement and preserved in perpetuity as an environmental commitment incorporated into the project. **Mitigation Measure AQR-MM-2: Site Project Facilities to Avoid Existing Shallow-Water Vegetated Habitat.** The project applicant will site project facilities at locations that avoid existing shallow-water vegetated habitat. The project applicant will retain a qualified botanist prior to final project design to conduct a survey of vegetation in shallow-water habitat, to help site facilities in locations that will minimize adverse effects to shallow-water vegetated habitat to the maximum extent practicable. **Mitigation Measure AQR-MM-3: Limit Waterside Construction to Less Sensitive Time Periods (August-October).** The project applicant will limit water side construction of the project to the August through October time period. This will minimize exposure of sensitive species such as delta smelt to the possible adverse effects of construction activities. *Significance after Mitigation: less than significant* ***Cumulatively considerable and unavoidable***	
AQR-2: Operation-Related Increase in Organic Materials and Toxics and Decrease in Dissolved Oxygen of Delta Water from Project Discharges.	
NAA: There would be no discharges from the project islands related to water storage. However, adverse effects to special-status fish species would continue to be present in the form of increased discharge of agricultural drainage water from the project islands.	S
A1, A2: Although the project's environmental commitments and FOC terms include project operating restrictions that preclude significant effects of the project on DO levels and avoid a substantial reduction in habitat for fish and other aquatic species, water discharged from Bacon Island may contain materials that would be toxic to aquatic organisms.	S
A3: Although the project's environmental commitments and FOC terms include project operating restrictions that preclude significant effects of the project on DO levels and avoid a substantial reduction in habitat for fish and other aquatic species, water discharged from project islands may contain materials that would be toxic to aquatic organisms.	S

NAA (No-Action Alternative) A1 (Alternative 1) A2 (Alternative 2) A3 (Alternative 3) B (Beneficial)
NE (No effect) LTS (Less than significant) PS (Potentially significant) S (Significant) SU (Significant and unavoidable)

Table ES-1
Summary of Effects and Mitigation Measures

	Effect	Significance
	Mitigation	
NAA: No mitigation is required. **A1, A2, A3: Implement Mitigation Measure HZ-MM-1** *Significance after Mitigation: less than significant*		
AQR-3: Temperature-Related Effects on Chinook Salmon and Other Species from Project Operations.		
NAA:	There would be no discharges from the project islands related to water storage. However, adverse effects to Chinook salmon and other fish species would occur in the form of increased discharge of agricultural drainage water from the project islands that may be warmer than the surrounding Delta waterways.	S
A1, A2:	Project environmental commitments and FOC terms include operating restrictions that preclude significant effects of the project on temperature levels and would therefore avoid a substantial reduction in habitat for fish and other aquatic species.	LTS
A3:	Project environmental commitments and FOC terms include project operating restrictions that preclude significant effects of the project on temperature levels and would thereby avoid a substantial reduction in habitat for fish and other aquatic species.	LTS
NAA: No mitigation is required. **A1, A2, A3:** No mitigation is required.		
AQR-4: Potential Effects to Aquatic Life Resulting from an Increase in Accidental Spills of Fuel and Other Materials and Boat Wake Erosion During Project Operations.		
NAA:	Under the No-Action Alternative, no new recreational facilities or maintenance boat docks would be constructed and there would be no new project-related boat activity that could result in an increase in accidental spills of fuel and other materials or boat wake erosion in Delta waterways adjacent to the project islands.	NE
A1, A2:	Construction and operation of the proposed water storage facilities would result in only minor increases in boat traffic. These increases would not result in substantial new effects to aquatic life related to accidental fuel and oil spills from boat wake erosion.	LTS
A3:	Construction and operation of the proposed water storage facilities would result in only minor increases in boat traffic. These increases would not result in substantial new effects to aquatic life from accidental fuel and oil spills or from boat wake erosion.	LTS
NAA: No mitigation is required. **A1, A2, A3:** No mitigation is required.		

NAA (No-Action Alternative) A1 (Alternative 1) A2 (Alternative 2) A3 (Alternative 3) B (Beneficial)
NE (No effect) LTS (Less than significant) PS (Potentially significant) S (Significant) SU (Significant and unavoidable)

Table ES-1
Summary of Effects and Mitigation Measures

Effect	Significance
Mitigation	
AQR-5: Effects on Juvenile Chinook Salmon from Project Diversions and Releases.	
NAA: The No-Action Alternative would not entail any diversions or releases related to water storage. Adverse effects to Chinook salmon would increase commensurate with the increase in unscreened agricultural diversions on the four project islands from intensified agricultural operations.	S
A1, A2, A3: Project operations would result in small increases in entrainment during certain periods and these fish may represent an important loss to the population in terms of genetically fitter individuals.	S
NAA: No mitigation is required.	
A1, A2, A3: Implement Mitigation Measure AQR-MM-1	
Mitigation Measure AQR-MM-4: Implement a Fishery Improvement Mitigation Fund. The project applicant will implement a fishery improvement mitigation fund that will provide monetary compensation to support habitat enhancement and conservation of fish populations. Annual fund contributions would be based on the annual quantity of water diverted to the Reservoir Islands, the amount of this water exported, and project effects. Previously, DFW and NMFS imposed permit terms that called for between $750-1,250/thousand acre-feet (TAF) for diversions during October through August and $2,250/TAF for export discharges. Revised permit terms may be established by USFWS, DFW, and NMFS. Initial funding will be provided by the project applicant prior to implementing the project.	
Use of the monies from the fund will be at the discretion of the resource agencies that would implement actions to improve habitat conditions and decrease mortality for species affected by the project; it is expected that money from the fund will be contributed to several of the following improvement actions:	
▸ **Augmenting spawning and rearing habitat for salmonids in tributaries of the Central Valley.** For example, funding could be provided toward the Battle Creek Salmon and Steelhead Restoration Project implemented by DWR, Reclamation, USFWS, DFW, and NMFS.	
▸ **Restoring habitat within the Delta.** There are opportunities to contribute funds to the Delta Pumping Plant Fish Protection Agreement (i.e., Four Pumps Agreement), which calls for cost-sharing and has successfully conducted restoration projects, installed screens and barriers, and increased enforcement in the Delta.	
▸ **Rearing and releasing additional fish.** There is an opportunity to contribute to the U.C. Davis/USFWS Fish Conservation and Culture Facility that is currently rearing delta smelt as a safeguard against further declines in the wild population but requires additional facilities to maintain sufficient family groups to maintain genetic diversity.	
▸ **Improving fish salvage operations.** There is an opportunity to contribute to DWR and Reclamation's efforts to improve salvage techniques at the SWP and CVP fish facilities in accordance with the 2009 NMFS OCAP BO.	
Significance after Mitigation: significant and unavoidable	
Cumulatively considerable and unavoidable	

NAA (No-Action Alternative) A1 (Alternative 1) A2 (Alternative 2) A3 (Alternative 3) B (Beneficial)
NE (No effect) LTS (Less than significant) PS (Potentially significant) S (Significant) SU (Significant and unavoidable)

Table ES-1
Summary of Effects and Mitigation Measures

Effect	Significance
Mitigation	
AQR-6: Effects on Juvenile Steelhead from Project Diversions and Releases.	
NAA: The No-Action Alternative would not entail any diversions or releases related to water storage. However, adverse effects to steelhead would increase commensurate with the increase in unscreened agricultural diversions on the four project islands from intensified agricultural operations.	S
A1, A2, A3: Project operations would result in small increases in entrainment during certain periods, and these fish may represent an important loss to the population in terms of genetically fitter individuals.	S
NAA: No mitigation is required. **A1, A2, A3: Implement Mitigation Measures AQR-MM-1 and AQR-MM-4** ***Significance after Mitigation: significant and unavoidable*** ***Cumulatively considerable and unavoidable***	
AQR-7: Effects on Delta Smelt from Project Diversions and Releases.	
NAA: The No-Action Alternative would not entail any diversions or releases related to water storage. However, adverse effects to delta smelt would increase commensurate with the increase in unscreened agricultural diversions on the four project islands from intensified agricultural operations.	S
A1, A2, A3: Project operations would result in small increases in entrainment during certain periods; however, given the long-term downward trend in abundance of delta smelt, this effect is significant.	S
NAA: No mitigation is required. **A1, A2, A3: Implement Mitigation Measures AQR-MM-1 and AQR-MM-4** ***Significance after Mitigation: significant and unavoidable*** ***Cumulatively considerable and unavoidable***	
AQR-8: Effects on Longfin Smelt from Project Diversions and Releases.	
NAA: The No-Action Alternative would not entail any diversions or releases related to water storage. However, adverse effects to longfin smelt would increase commensurate with the increase in unscreened agricultural diversions on the four project islands from intensified agricultural operations.	S

NAA (No-Action Alternative) A1 (Alternative 1) A2 (Alternative 2) A3 (Alternative 3) B (Beneficial)
NE (No effect) LTS (Less than significant) PS (Potentially significant) S (Significant) SU (Significant and unavoidable)

Table ES-1
Summary of Effects and Mitigation Measures

Effect	Significance
Mitigation	
A1, A2, A3: Project operations would result in small increases in entrainment during certain periods and given that these losses could be important to the overall abundance of green sturgeon, this effect is considered significant.	S
NAA: No mitigation is required. **A1, A2, A3: Implement Mitigation Measures AQR-MM-1 and AQR-MM-4** ***Significance after Mitigation: significant and unavoidable*** ***Cumulatively considerable and unavoidable***	
AQR-9: Effects on Green Sturgeon from Project Diversions and Releases.	
NAA: The No-Action Alternative would not entail any diversions or releases related to water storage. However, adverse effects to green sturgeon would increase commensurate with the increase in unscreened agricultural diversions on the four project islands from intensified agricultural operations.	S
A1, A2, A3: Project operations would result in small increases in entrainment during certain periods and given that these losses could be important to the overall abundance of green sturgeon, this effect is considered significant.	S
NAA: No mitigation is required. **A1, A2, A3: Implement Mitigation Measure AQR-MM-4** ***Significance after Mitigation: significant and unavoidable*** ***Cumulatively considerable and unavoidable***	
AQR-10: Effects on Other Aquatic Species from Project Diversions and Releases.	
NAA: The No-Action Alternative would not entail any diversions or releases related to water storage that could affect common fish and invertebrate species inhabiting the Delta. However, adverse effects to these species would increase commensurate with the increase in unscreened agricultural diversions on the four project islands from intensified agricultural operations. Given the current common status of these species in the Delta, this effect is less than significant.	LTS
A1, A2, A3: Project operations would result in small increases in entrainment during certain periods. However, no substantial reduction in abundance, range, or habitat for any other species is anticipated.	LTS
NAA: No mitigation is required.	

NAA (No-Action Alternative) A1 (Alternative 1) A2 (Alternative 2) A3 (Alternative 3) B (Beneficial)
NE (No effect) LTS (Less than significant) PS (Potentially significant) S (Significant) SU (Significant and unavoidable)

Table ES-1
Summary of Effects and Mitigation Measures

Effect	Significance
Mitigation	
A1, A2, A3: No mitigation is required.	
AQR-11: Project Effects to Wetlands and Other Waters of the U.S. from Construction and Operation.	
NAA: The No-Action Alternative would not entail new construction or operation of reservoirs or Habitat Islands that could affect wetlands and other waters of the U.S. However, fallow, herbaceous upland, riparian, and wetland habitats would be converted to agricultural use commensurate with intensified agricultural operations. Therefore, adverse effects to wetlands and other waters of the U.S. would occur.	S
A1, A2: Excluding the approximately 10,798 acres of seasonal open water habitat type that would be created with the construction of the Reservoir Islands, implementation of Alternatives 1 and 2 would result in a net increase of approximately 1,033 acres of wetlands and 102.8 acres of other waters of the U.S.	LTS, B
A3: Alternative 3 would result in a loss of approximately 3,699 acres of wetlands and other waters of the U.S.	S
NAA: No mitigation is required. **A1, A2:** No mitigation is required. **A3: Mitigation Measure AQR-MM-5: Compensate for Loss of Wetlands through an Off-Site Compensatory Mitigation Site.** To offset effects to wetlands and other Waters of the U.S. resulting from implementation of Alternative 3, the project applicant, in consultation with USACE, USFWS, EPA, and DFW, will develop and implement an off-site wetland mitigation plan for mitigating effects to Section 404 jurisdictional wetlands and other waters of the U.S. Wetland mitigation available at the NBHA may be considered as part of this plan. The off-site mitigation plan shall compensate for wetland losses at a ratio no less than 1:1. The required acreage may be higher, depending on the function and services of restored habitats that would be provided under the plan. Once suitable off-site mitigation areas have been identified, a CMP team will be established to develop the off-site mitigation plan. No project-related construction will be allowed until a compensation plan that guarantees adequate compensation acreage has been developed by the project applicant and approved by USACE, USFWS, EPA, and DFW. *Significance after Mitigation: less than significant* ***Not cumulatively considerable with mitigation***	
AQR-12: Loss of Tidal Marsh and Tidal Channel Habitats from Project Construction and Operation.	
NAA: The No-Action Alternative would not entail new construction or operation of reservoirs or Habitat Islands that could cause the loss of tidal marsh and tidal channel habitats. Ongoing levee maintenance activities, however, would result in permanent loss of tidal marsh and Delta channel habitat occurring on the outside of the levees on the project islands.	S
A1, A2: Implementation of off-site compensatory mitigation could result in habitat conversion and indirect loss of jurisdictional wetland habitat.	LTS

NAA (No-Action Alternative) A1 (Alternative 1) A2 (Alternative 2) A3 (Alternative 3) B (Beneficial)
NE (No effect) LTS (Less than significant) PS (Potentially significant) S (Significant) SU (Significant and unavoidable)

Table ES-1
Summary of Effects and Mitigation Measures

Effect	Significance
Mitigation	
AQR-12: Habitat Conversion and Potential Indirect Effects on Jurisdictional Wetlands from Implementing Off-Site Mitigation	
A3: Implementation of off-site compensatory mitigation could result in habitat conversion and indirect loss of jurisdictional wetland habitat.	PS
NAA: No mitigation is required. **A1, A2:** No mitigation is required. **A3: Implement Mitigation Measure BIO-MM-7**	
AQR-13: Habitat Conversion and Potential Effects on Associated Special-Status Species from Implementing Chipps Island Conservation Easement.	
A1, A2: The Chipps Island Conservation Easement would result in permanent protection of 200 acres of existing tidal channel and 40 acres of existing shallow water tidal marsh habitat. This effect is less than significant and beneficial.	B, LTS
AQR-13: Loss of Tidal Marsh and Tidal Channel Habitats from Project Construction and Operation.	
A3: Permanent loss of tidal marsh and tidal channel habitats would occur outside of the levees on the project islands, but the project's environmental commitment to provide a conservation easement on Chipps Island would compensate for this loss.	LTS
A1, A2, A3: No mitigation is required.	
AQR-14: Habitat Conversion and Potential Indirect Effects on Associated Special-Status Species from Implementing Chipps Island Conservation Easement.	
A3: The Chipps Island Conservation Easement would result in permanent protection of 200 acres of existing tidal channel and 40 acres of existing shallow water tidal marsh habitat.	LTS, B
A3: No mitigation is required.	
3.5 BIOLOGICAL RESOURCES	
BIO-1: Introduction and Spread of Invasive Plants.	
NAA: Under the No-Action Alternative, existing agricultural activities would continue and habitats would not be restored or managed with the intent of controlling invasive plant species. However, the extent of introduction and spread would be limited due to crop management activities.	LTS
A1, A2: Habitat for special-status species could become degraded and thus unsuitable; therefore, construction activities and operations that may	LTS

NAA (No-Action Alternative) A1 (Alternative 1) A2 (Alternative 2) A3 (Alternative 3) B (Beneficial)
NE (No effect) LTS (Less than significant) PS (Potentially significant) S (Significant) SU (Significant and unavoidable)

Table ES-1
Summary of Effects and Mitigation Measures

Effect		Significance
Mitigation		
	introduce or facilitate the spread of invasive plant species would adversely affect habitat for special-status species.	
A3:	Project-related construction activities and operations that may introduce or facilitate the spread of invasive plant species would adversely affect habitat for special-status species.	LTS
NAA: No mitigation is required.		
A1, A2, A3: No mitigation is required.		
BIO-2: Loss of Special-Status Plants.		
NAA:	Under the No-Action Alternative, there would be no project-related construction or operational effects to existing populations of special-status plants. Adverse effects to special-status plants would continue to be present in the form of levee and agricultural-related maintenance activities; however, these are ongoing activities and the existing plant populations have existed under this condition over time.	LTS
A1, A2, A3:	Construction of the Reservoir Islands may adversely affect existing populations of special-status plants, including Mason's lilaeopsis.	PS
NAA: No mitigation is required.		
A1, A2, A3: Mitigation Measure BIO-MM-1: Implement Pre-Construction Surveys, Avoidance, and Compensation for Project Effects to Special-Status Plants. Before the initiation of any vegetation removal or ground-disturbing activities in areas that provide suitable habitat for special-status plants, the following measures shall be implemented by the project applicant: ▸ A qualified botanist will conduct appropriately-timed surveys for special-status plant species, including those identified in Table 3.5-2, in all suitable habitat that would be potentially disturbed by the project. ▸ Surveys shall be conducted following USFWS and DFW or approved protocols. ▸ If no special-status plants are found during focused surveys, the botanist shall document the findings in a letter to the appropriate agencies (DFW for state-listed species and USFWS for Federally listed species) and the project applicant, and no further mitigation will be required. If special-status plants are found during focused surveys, the following measures shall be implemented: ▸ Information regarding the special-status plant population shall be submitted to the CNDDB. ▸ If the populations can be avoided during project implementation, they shall be clearly marked in the field by a qualified botanist and avoided during construction activities. Before ground clearing or ground disturbance, all on-site construction personnel shall be instructed as to the species' presence and the importance of avoiding this species and its habitat.		

NAA (No-Action Alternative)	A1 (Alternative 1)	A2 (Alternative 2)	A3 (Alternative 3)	B (Beneficial)
NE (No effect)	LTS (Less than significant)	PS (Potentially significant)	S (Significant)	SU (Significant and unavoidable)

Table ES-1
Summary of Effects and Mitigation Measures

Effect	Significance
Mitigation	

- If special-status plant populations cannot be avoided, consultations with DFW and/or USFWS (depending on the listing status of the special-status plant) will take place. A plan to compensate for the loss of special-status plant species will be prepared, if required by DFW and/or USFWS, detailing appropriate replacement ratios, methods for implementation, success criteria, monitoring and reporting protocols, and contingency measures that would be implemented if the initial mitigation fails; the plan would be developed prior to the start of local construction activities and will be implemented concurrently with other project construction.
- If mitigation is required, the project applicant shall maintain and monitor the mitigation area for 5 years following the completion of construction and restoration activities. Monitoring reports shall be submitted to DFW and/or USFWS (depending on the listing status of the special-status plant being mitigated) at the completion of restoration and for the following 5 years. Monitoring reports shall include photodocumentation, planting specifications, a site layout map, descriptions of materials used, and justification for any deviations from the mitigation plan. If the monitoring indicates that the mitigation is not meeting the success criteria included in the mitigation plan, remedial measures shall be recommended.
- If remedial measures are recommended, the project applicant shall implement the remedial actions and continue annual monitoring and reporting until performance criteria have been met and the resource agencies (DFW for state-listed species and USFWS for Federally listed species) have deemed the mitigation adequate and complete.
- Monitoring and reporting may be considered adequate prior to the 5-year mark following the last implementation action, if plants are well established self-sustaining at the performance level targeted for the mitigation. This would require verification by the resource agencies (DFW for state-listed species and USFWS for Federally listed species).

Significance after Mitigation: *less than significant*

Not cumulatively considerable with mitigation

BIO-3: Potential Mortality of, and Potential Loss of Suitable Habitat for, Valley Elderberry Longhorn Beetle.

	Effect	Significance
NAA:	Under the No-Action Alternative, there would be no project-related construction or operational effects to VELB. Adverse effects to VELB would continue to be present in the form of levee and agricultural maintenance activities; however, these are ongoing activities and VELB has existed under this condition over time, and suitable habitat is only present in a small portion of the project area.	LTS
A1, A2:	Elderberry shrubs are present on Holland Tract, and construction-related activities may adversely affect VELB.	S
A3:	Elderberry shrubs are present on Holland Tract, and therefore reservoir construction activities may adversely affect VELB, which is Federally listed as threatened.	S

NAA: No mitigation is required.

A1, A2, A3: Mitigation Measure BIO-MM-2: Implement Protection, Restoration, and Maintenance Measures for Valley Elderberry Longhorn Beetle. The project applicant, in consultation with USFWS, will implement the following protective measures for elderberry shrubs on Holland Tract during habitat construction activities:

Table ES-1
Summary of Effects and Mitigation Measures

Effect	Significance
Mitigation	

Protective Measures:

1. Fence and flag all areas to be avoided during construction activities. In areas where encroachment on the 100-foot buffer area has been approved by USFWS, provide a minimum setback of at least 20 feet from the drip line of each elderberry plant.
2. Following the environmental construction worker training to be outlined in the Construction Implementation Plan, brief contractors on the need to avoid damaging the elderberry plants and the possible penalties for not complying with these requirements. Instruct work crews about the status of the beetle and the need to protect its elderberry host plant.
3. Erect signs every 50 feet along the edge of the avoidance area with the following information: “This area is habitat of the valley elderberry longhorn beetle, a threatened species, and must not be disturbed. This species is protected by the Endangered Species Act of 1973, as amended. Violators are subject to prosecution, fines, and imprisonment.” The signs should be clearly readable from a distance of 20 feet, and must be maintained for the duration of construction.

Compensation:

If elderberry plants within the buffer area are damaged during construction or cannot be avoided, the project applicant shall consult with USFWS to determine appropriate compensation. This may include transplanting elderberry plants that cannot be avoided or replacement of damaged elderberry plants at a location approved by USFWS.

Restoration and Maintenance:

1. Restore any damage that occurs in the buffer area (area within 100 feet of elderberry plants) during construction. Provide erosion control and revegetate with appropriate native plants.
2. The project applicant must provide a written description of how the buffer areas are to be restored, protected, and maintained after construction is completed. This shall be included in the Construction Implementation Plan.
3. No insecticides, herbicides, fertilizers, or other chemicals that might harm the beetle or its host plant should be used in the buffer areas, or within 100 feet of any elderberry plant with one or more stems measuring 1.0 inch or greater in diameter at ground level.
4. Mowing of grasses/ground cover may occur from July through April to reduce fire hazard. No mowing should occur within 5 feet of elderberry plant stems. Mowing must be performed in a manner that avoids damaging plants (e.g., stripping away bark through careless use of mowing/trimming equipment).

A3: Mitigation Measure BIO-MM-6: Compensate for Loss of Habitats for Special-Status Species and Migratory and Wintering Birds through an Off-Site Compensatory Mitigation Site. The project applicant, in consultation with USACE, DFW, and USFWS, will develop and implement an off-site compensatory mitigation plan to mitigate effects on habitats for special-status species and habitats. The mitigation area(s) will be located in San Joaquin and/or Contra Costa County and in the Delta, unless otherwise approved by DFW and USFWS. The plan will include adequate compensation to ensure no net loss of habitat, as well as provisions for long-term monitoring of the habitat mitigation areas to determine species’ use of the of the area and to ensure that habitats are being managed appropriately for species included in the plan. Monitoring reports will be prepared and submitted to DFW and USFWS on a schedule to be determined in consultation with the agencies. No water diversion/storage will be permitted until the mitigation plan and mitigation implementation schedule has been approved by the DFW and USFWS. In general, the plan will include the specifications and measures as described in the Draft CMP for Alternatives 1 and 2; however, mitigation ratios may be

NAA (No-Action Alternative) A1 (Alternative 1) A2 (Alternative 2) A3 (Alternative 3) B (Beneficial)
NE (No effect) LTS (Less than significant) PS (Potentially significant) S (Significant) SU (Significant and unavoidable)

Table ES-1
Summary of Effects and Mitigation Measures

Effect	Significance
Mitigation	
modified during consultation with DFW and USFWS and mitigation may take place on other islands in the Delta, including areas of Chipps Island that are owned by the project applicant. ***Significance after Mitigation:*** *less than significant* ***Not cumulatively considerable with mitigation***	
BIO-4: Potential Injury or Mortality of Giant Garter Snake.	
NAA: Under the No-Action Alternative, there would be no project-related construction or operational effects to giant garter snake. Adverse effects to giant garter snake would continue to be present in the form of levee, ditch, canal, and other agricultural maintenance activities, and giant garter snake populations have declined substantially.	S
A1, A2, A3: Suitable habitat for giant garter snake is present on the project islands, and construction activities could result in the incidental take of giant garter snake.	S
NAA: No mitigation is required. **A1, A2, A3: Mitigation Measure BIO-MM-3: Implement Protection Measures for Giant Garter Snake.** 5. All construction activity within giant garter snake habitat shall be conducted between May 1 and October 1. For any construction activities that would need to take place between October 2 and April 30, the applicant will contact USFWS to determine if additional measures are necessary to minimize and avoid take. If additional measures are deemed necessary, the applicant will implement these measures as required by USFWS. 6. Any dewatered habitat must remain dry for at least 15 consecutive days after April 15 and prior to excavating or filling of the dewatered habitat. 7. Construction personnel shall participate in a USFWS-approved worker environmental awareness program. Under this program, workers shall be informed about the presence of giant garter snakes and habitat associated with the species and that unlawful take of the animal or destruction of its habitat is a violation of the Act. Prior to construction activities, a qualified biologist approved by USFWS shall instruct all construction personnel about: (1) the life history of the giant garter snake; (2) the importance of irrigation canals, marshes/wetlands, and seasonally flooded areas, such as rice fields, to the giant garter snake; and (3) the terms and conditions of the biological opinion (as applicable). Proof of this instruction shall be submitted to USFWS. 8. Within 24-hours prior to commencement of construction activities, the site shall be inspected by a USFWS-approved biologist. The biologist will provide the USFWS with a field report form documenting the monitoring efforts within 24 hours of commencement of construction activities. The monitoring biologist needs to be available thereafter; if a snake is encountered during construction activities, the monitoring biologist shall have the authority to stop construction activities until appropriate corrective measures have been completed or it is determined that the snake will not be harmed. Giant garter snakes encountered during construction activities should be allowed to move away from construction activities on their own. The biologist shall be required to report any incidental take to the USFWS immediately. The project area shall be re-inspected whenever a lapse in construction activity of 2 weeks or greater has occurred. 9. Clearing of wetland vegetation will be confined to the minimal area necessary to excavate the toe of banks for riprap or fill placement. Excavation of channels for removal of accumulated sediments will be accomplished by using equipment located on and operated from the top of the bank, with the least interference practical for emergent vegetation.	

NAA (No-Action Alternative) A1 (Alternative 1) A2 (Alternative 2) A3 (Alternative 3) B (Beneficial)
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Table ES-1
Summary of Effects and Mitigation Measures

Effect	Significance
Mitigation	
10. Movement of heavy equipment to and from the project site shall be restricted to established roadways to minimize habitat disturbance. 11. Preserved giant garter snake habitat shall be designated as an "Environmentally Sensitive Area" and shall be flagged by a USFWS-approved biologist and avoided by all construction personnel. 12. After completion of construction activities, any temporary fill and construction debris shall be removed and, wherever feasible, disturbed areas shall be restored to pre-project conditions. Restoration work may include replanting emergent vegetation. ***Significance after Mitigation:*** *less than significant* ***Not cumulatively considerable with mitigation***	
BIO-5: Loss of Suitable Aquatic and Upland Habitat for Giant Garter Snake.	
NAA: Under the No-Action Alternative, there would be no project-related construction, conversion, modification, or loss of aquatic or upland habitat for giant garter snake. Agricultural land uses are known to provide suitable aquatic and upland habitat for giant garter snake.	LTS
A1, A2: Construction of the Reservoir Islands would result in the loss of suitable aquatic and upland habitat for giant garter snake.	LTS
A3: Construction of the Reservoir Islands would result in the direct loss of suitable aquatic and upland habitat for giant garter snake.	S
NAA: No mitigation is required. **A1, A2:** No mitigation is required. **A3: Implement Mitigation Measures BIO-MM-3 and BIO-MM-6** ***Significance after Mitigation:*** *less than significant* ***Not cumulatively considerable with mitigation***	
BIO-6: Potential Injury or Mortality of Swainson's Hawk.	
NAA: Under the No-Action Alternative, there would be no project-related construction or operational effects to Swainson's hawk or suitable habitat. Adverse effects to Swainson's hawk would continue to be present in the form of levee and other agricultural maintenance activities, which could result in the removal of trees with active nests.	S
A1, A2: Suitable nesting habitat is present on the project islands, and construction activities may result in the incidental take of active nest sites.	S

NAA (No-Action Alternative) A1 (Alternative 1) A2 (Alternative 2) A3 (Alternative 3) B (Beneficial)
NE (No effect) LTS (Less than significant) PS (Potentially significant) S (Significant) SU (Significant and unavoidable)

Table ES-1
Summary of Effects and Mitigation Measures

Effect Mitigation	Significance
A3: Suitable Swainson's hawk nesting habitat is present on the project islands, and therefore construction activities may result in the incidental take of active nest sites.	S
NAA: No mitigation is required. **A1, A2, A3: Mitigation Measure BIO-MM-4: Implement Protection Measures for Swainson's Hawk.** 13. No more than 30 days prior to construction, suitable Swainson's hawk nesting habitat in the construction area and within a buffer of 1/2 mile will be surveyed by a qualified biologist during the breeding season. The survey will be performed in accordance with DFW's *Recommended Timing and Methodology for Swainson's Hawk Nesting Surveys in California's Central Valley*. Any active nest sites will be documented and protected per the requirements in (2), below. The results of the survey will be documented in a report to be submitted to DFW. 14. No construction activities should be initiated within 1/2 mile (i.e., the buffer zone) of an active nest between March 1 and September 15. If construction or other project-related activities that may cause nest abandonment or forced fledging are necessary within the buffer zone, with DFW approval, the nest site may be monitored by a qualified biologist with authority to stop construction should the hawks show signs of stress, such as nest abandonment and loss of young. ***Significance after Mitigation:*** *less than significant*	
BIO-7: Loss of Suitable Foraging and Nesting Habitat for Swainson's Hawk.	
NAA: Under the No-Action Alternative, there would be no project-related construction, conversion, modification, or loss of suitable foraging and/or nesting habitat for Swainson's hawk. Agricultural land uses are known to provide suitable foraging habitat and nesting habitat has existed on the project islands under the current agricultural management condition over time.	LTS
A1, A2: Development of the Reservoir Islands would result in a loss of suitable foraging and nesting habitat for Swainson's hawk.	LTS
A3: Development of the proposed reservoirs would result in a net decrease in available Swainson's hawk foraging and nesting habitat.	S
NAA: No mitigation is required. **A1, A2:** No mitigation is required. **A3: Implement Mitigation Measure BIO-MM-6** ***Significance after Mitigation:*** *less than significant* ***Not cumulatively considerable with mitigation***	

NAA (No-Action Alternative)	A1 (Alternative 1)	A2 (Alternative 2)	A3 (Alternative 3)	B (Beneficial)
NE (No effect)	LTS (Less than significant)	PS (Potentially significant)	S (Significant)	SU (Significant and unavoidable)

Table ES-1
Summary of Effects and Mitigation Measures

Effect		Significance
Mitigation		
BIO-8: Loss of Foraging Habitats for Migratory or Wintering Waterfowl.		
NAA:	Under the No-Action Alternative, there would be no project-related construction, conversion, modification, or loss of suitable foraging and/or nesting habitat to migratory or wintering waterfowl. Adverse effects to waterfowl and their habitat would continue to be present in the form of agricultural activities; however, these are ongoing activities and habitat for waterfowl has existed under this condition over time. Further, migratory and wintering waterfowl are dependent on a variety of wetland and upland habitat types in the Delta, including agricultural crops (primarily corn and wheat) for forage, which would continue to be present under the No-Action Alternative.	LTS
A1, A2:	The project islands provide winter foraging habitat for migratory waterfowl and are located within the Pacific Flyway; therefore, construction may result in a loss in habitat for migratory or wintering waterfowl.	LTS
A3:	The project islands provide winter foraging habitat for migratory waterfowl and are located within the Pacific Flyway, and therefore project construction activities may result in a loss in habitat for migratory or wintering waterfowl.	S
NAA: No mitigation is required. **A1, A2:** No mitigation is required. **A3: Implement Mitigation Measure BIO-MM-6** ***Significance after Mitigation:*** *less than significant* ***Not cumulatively considerable with mitigation***		
BIO-9: Increase in Suitable Foraging Habitat for Greater Sandhill Crane.		
NAA:	Under the No-Action Alternative, there would be no project-related construction or operational effects to greater sandhill crane or its suitable habitat. Adverse effects to sandhill crane and its habitat would continue to be present in the form of agricultural activities; however, these are ongoing activities and habitat for sandhill crane has existed under this condition over time. Further, greater sandhill crane forages in agricultural lands such as corn and grain fields, and pastures, which would continue to be present under the No-Action Alternative.	LTS
A1, A2:	Existing foraging habitat for greater sandhill crane on the Reservoir Islands would be lost, but construction of the Habitat Islands would result in an increase in foraging habitat for this species.	LTS, B
BIO-9: Loss of Suitable Foraging Habitat for Greater Sandhill Crane.		
A3:	The project islands provide foraging habitat for greater sandhill crane, and construction activities may result in a loss in foraging habitat for this species.	S

NAA (No-Action Alternative) A1 (Alternative 1) A2 (Alternative 2) A3 (Alternative 3) B (Beneficial)
NE (No effect) LTS (Less than significant) PS (Potentially significant) S (Significant) SU (Significant and unavoidable)

Table ES-1
Summary of Effects and Mitigation Measures

Effect	Significance
Mitigation	
NAA: No mitigation is required. **A1, A2:** No mitigation is required. **A3: Implement Mitigation Measure BIO-MM-6** ***Significance after Mitigation:*** *less than significant* ***Not cumulatively considerable with mitigation***	
BIO-10: Potential Injury or Mortality to Migratory Birds.	
NAA: Under the No-Action Alternative, there would be no project-related construction or operational effects to migratory birds or suitable habitat. Adverse effects to migratory birds and their habitat would continue to be present in the form of levee and other agricultural maintenance activities; however, these are ongoing activities and habitat for migratory birds has existed under this condition over time. Nevertheless, because levee maintenance and agricultural activities could result in the destruction of active nests, this effect is significant.	S
A1, A2: The project islands provide suitable nesting habitat for birds protected under the Migratory Bird Treaty Act, and project-related construction may result the take of protected birds defined therein.	S
A3: The project islands provide suitable nesting habitat for birds protected under the Migratory Bird Treaty Act, and construction activities may result the take of protected birds as defined therein.	S
NAA: No mitigation is required. **A1, A2, A3: Mitigation Measure BIO-MM-5: Implement Protection Measures for Migratory Birds.** 15. No more than 30 days prior to construction, suitable nesting habitat in the construction area and within a 500-foot buffer will be surveyed by a qualified biologist during the breeding season to identify any active nest sites. Any active nest sites will be documented and protected per the requirements of (2), below. The results of the survey will be documented in a report to be submitted to DFW. 16. No construction activities should be initiated within 500 feet of an active nest between March 1 and August 15. If construction or other project related activities that may cause nest abandonment or forced fledging are necessary within the buffer zone, with DFW approval, the nest site may be monitored by a qualified biologist with authority to stop construction should birds show signs of stress such as nest abandonment and loss of young. ***Significance after Mitigation:*** *less than significant*	
BIO-11: Habitat Conversion and Potential Effects on Associated Special-Status Species from Off-Site Mitigation.	
A3: Implementation of off-site compensatory mitigation could result in habitat conversion and loss of associated special-status species.	PS
A3: Mitigation Measure BIO-MM-7: Conduct Detailed Effects Assessment for Off-Site Mitigation Sites, Quantify Effects, and Include Necessary Mitigation	

NAA (No-Action Alternative) A1 (Alternative 1) A2 (Alternative 2) A3 (Alternative 3) B (Beneficial)
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Table ES-1
Summary of Effects and Mitigation Measures

Effect	Significance
Mitigation	
in the Off-Site Compensatory Mitigation Plan. If Alternative 3 is selected for implementation, the project applicant shall implement the following: ▸ determine the exact location for off-site mitigation; ▸ determine the habitat types that are present and assess their potential to support special-status species; this should include all species addressed under the effects analysis for Alternatives 1 and 2 but may include additional species, due to location or due to the presence of additional habitat types; ▸ assess the potential of the off-site mitigation site to support special-status species; ▸ conduct focused surveys for special-status species, if potential habitat is present; ▸ based on habitat mapping and focused surveys, quantify the effects to common and sensitive natural communities and special-status species according to same methodology used for Alternatives 1 and 2; ▸ include adequate mitigation in the off-site mitigation plan to account for habitat conversion and special-status species effects resulting from off-site mitigation, in addition to the effects on the project islands resulting from project implementation; and ▸ obtain regulatory agency approval for off-site mitigation plan prior to project implementation. ***Significance after Mitigation:*** *less than significant*	
3.6 CLIMATE CHANGE	
CC-1: Increase in CO_2e Emissions on Project Islands During Construction.	
NAA: No project-related construction activities would occur.	NE
A1, A2, A3: Project implementation would generate CO_2e emissions from construction activities, but would not exceed the DWR CAP threshold.	LTS
NAA: No mitigation is required. **A1, A2, A3:** No mitigation is required.	

NAA (No-Action Alternative) A1 (Alternative 1) A2 (Alternative 2) A3 (Alternative 3) B (Beneficial)
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Table ES-1
Summary of Effects and Mitigation Measures

Effect		Significance
Mitigation		
CC-2: Increase in CO_2e Emissions on Project Islands During Operation.		
NAA:	Long-term operational emissions of CO_2e would be generated at the project area under the No-Action Alternative, and would be substantially greater than any of the three action alternatives.	LTS
A1, A2, A3:	Following completion of construction activities, long-term operational emissions of CO_2e would be generated at the project area. However, project emissions would be substantially reduced as compared to existing conditions.	B, LTS
NAA: No mitigation is required.		
A1, A2, A3: No mitigation is required.		
CC-3: Consistency with the Applicable GHG Reduction Plan.		
NAA:	The proposed change in land uses from agriculture to water infrastructure would not occur, and agricultural land uses are not subject to DWR's Climate Action Plan.	NE
A1, A2, A3:	The project's design and purpose would be consistent with the goals and strategies of the DWR Climate Action Plan and AB 32 Scoping Plan.	LTS
NAA: No mitigation is required.		
A1, A2, A3: No mitigation is required.		
3.7 CULTURAL RESOURCES		
CUL-1: Destruction of Historic Buildings and Structures from Agricultural Practices.		
NAA:	The use of historic structures as boarding houses could affect their integrity and potential eligibility under NRHP.	LTS
A1, A2:	Because properties on Bacon Island are eligible for NRHP listing as a historic district, the effect of implementation of Alternatives 1 and 2 on the district as a whole must be assessed. In addition, implementation of Alternatives 1 and 2 may damage the Mokelumne River Swing Truss Bridge, which is eligible for NRHP listing.	S
A3:	Because properties on Bacon Island are eligible for NRHP listing as a historic district, the effect of implementation of Alternative 3 on the district as a whole must be assessed. Implementation of Alternative 3 may also damage NRHP-eligible Mokelumne River Swing Truss	

NAA (No-Action Alternative) A1 (Alternative 1) A2 (Alternative 2) A3 (Alternative 3) B (Beneficial)
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Table ES-1
Summary of Effects and Mitigation Measures

Effect	Significance
Mitigation	
Bridge.	
NAA: No mitigation is required. **A1, A2, A3: Mitigation Measure CUL-MM-1: Prepare and Implement a Historic Properties Treatment Plan.** Prior to implementation of any project activities, per the requirements of the PA the lead agency will ensure that a Historic Properties Treatment Plan (HPTP) is prepared and implemented by individuals who meet the Secretary of Interior's Standards for Archaeology, History, and Architectural History. The HPTP will include the following components: **Mitigation Measure CUL-MM-1a: Complete Historic Research, Measured Drawings, and Photographic Documentation of the NRHP-Eligible Property.** This documentation will meet the minimum requirements of the Historic American Building Survey/Historic American Engineering Record/Historic American Landscape Survey for resources with national significance. This component of the HPTP will be completed before components CUL-MM-1c and CUL-MM-1d so the results may be integrated into the products required by those components. **Mitigation Measure CUL-MM-1b: Prepare and Implement an Archaeological Resources Data Recovery Plan.** This plan will specify how significant archaeological data will be recovered from the sites, analyzed, and reported to professionals and the public. This component of the HPTP will be completed before components CUL-MM-1c and CUL-MM-1d so the results may be integrated into the products required by those components. **Mitigation Measure CUL-MM-1c: Produce a Publication to Disseminate Historical Information Regarding the NRHP-Eligible Property to the Public.** This document should combine historical photographs with information gathered from historical research and interviews to describe the history of the NRHP-eligible properties and its relevance to modern society. The publication should be prepared for use by schools, historical societies, local museums, and the general public. **Mitigation Measure CUL-MM-1d: Prepare a Video That Disseminates Historical Information and Explains the Character-Defining Features of the NRHP-Eligible Property to the Public.** This production should be prepared to meet the technical requirements for airing on the Public Broadcasting System (as specified in the PBS producers' handbook). ***Significance after Mitigation: significant and unavoidable*** ***Cumulatively significant and unavoidable***	
CUL-2: Destruction of Levees and Built Environment Resources from Agricultural Practices. **NAA:** Agricultural activities could affect levees and unevaluated built environment resources within the APE.	LTS
CUL-2: Destruction of Levees and Unevaluated Built Environment Resources. **A1, A2, A3:** The levees and the built environment resources within the APE have not been assessed and could be eligible for NRHP listing; therefore, implementation may damage these resources.	PS
NAA: No mitigation is required. **A1, A2, A3: Implement Mitigation Measure CUL-MM-1, components 1a, 1c, and 1d** **Mitigation Measure CUL-MM-2: Inventory and Evaluate Built Environment Resources.** Per the PA, prior to implementation of any project activities, the project applicant will ensure that all resources in the APE 50 years old or older have been	

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Table ES-1
Summary of Effects and Mitigation Measures

Effect	Significance
Mitigation	
inventoried and evaluated for NRHP significance. The assessments will be prepared according to the Secretary of the Interior's standards and guidelines for evaluated resources. In accordance with the PA, if resources are found not eligible for the NRHP no further considerations need to be given to these properties. ***Significance after Mitigation: significant and unavoidable*** ***Cumulatively significant and unavoidable***	
CUL-3: Disturbance to Archaeological Remains from Agricultural Practices.	
NAA: Agricultural activities could disturb buried resources within the project area; however, these activities would not substantially alter from the existing conditions.	LTS
CUL-3: **Disturbance to Archaeological Remains as a Result of Compaction, Inundation, Wave-Induced Erosion, or Habitat Development and Management.**	
A1, A2, A3: Because the value of archaeological resources often depends on their integrity, project activities that disturb buried resources could change their status under the NRHP.	PS
NAA: No mitigation is required. **A1, A2: Implement Mitigation Measure CUL-MM-1, component 1b** **Mitigation Measure CUL-MM-1e: Provide Methods and Guidance for Subsurface Testing in the Form of Remote Sensing and Excavation.** This testing will determine the presence or absence of significant archaeological remains within archaeologically sensitive areas of the project APE. If significant archaeological resources are identified, prepare and implement an archaeological resources data recovery plan that specifies how significant archaeological data will be recovered from the APE, analyzed, and reported to professionals and the public. Specify notification procedures in the event of discovery of cultural materials in archaeologically sensitive areas. The HPMP will include a monitoring plan to address effects resulting from inadvertent discovery of cultural resources during ongoing project operations and will outline treatment and management requirements for these resources. **Mitigation Measure CUL-MM-1f: Steps to Implement for the Discovery of Cultural Resources.** Per the PA, if previously unidentified cultural resources are discovered during project construction or operation, the project applicant, in consultation with USACE, SWRCB, and SHPO, shall collect sufficient information to determine whether the resources are eligible for the NRHP and determine appropriate treatment. The steps necessary to determine NRHP eligibility and appropriate treatment for unanticipated discoveries will be outlined in the HPMP and in a monitoring plan. **A3: Implement Mitigation Measure CUL-MM-1, components 1b, 1e, and 1g** **Mitigation Measure CUL-MM-1h: Prepare and Implement an Archaeological Resources Data Recovery Plan for Site-Specific Resource**s. This plan will specify how "significant" (as that term is defined under NEPA) archaeological data will be identified; recovered from sites CA-SJO-208H, CA-SJO-210H, and CA-CCO-147; analyzed; and reported to professionals and the public. ***Significance after Mitigation: less than significant***	

NAA (No-Action Alternative) A1 (Alternative 1) A2 (Alternative 2) A3 (Alternative 3) B (Beneficial)
NE (No effect) LTS (Less than significant) PS (Potentially significant) S (Significant) SU (Significant and unavoidable)

Table ES-1
Summary of Effects and Mitigation Measures

Effect	Significance
Mitigation	
CUL-4: Disturbance to Human Remains as a Result of Agricultural Activities.	
NAA: Ground-disturbing activities could uncover previously undiscovered human burials within the project area; however, these activities would not cause additional disturbance to the human remains.	LTS
CUL-4: Disturbance to Human Remains as a Result of Compaction, Inundation, Wave-Induced Erosion, Habitat Development and Management, or Vandalism.	
A1, A2, A3: Ground-disturbing activities could uncover previously undiscovered human burials within the project area.	PS
NAA: No mitigation is required. **A1, A2: Implement Mitigation Measure CUL-MM-1, components 1b, and 1e** Mitigation Measure CUL-MM-1g: Negotiate, Prepare, and Implement a Preburial Agreement with the Most Likely Descendant (as Determined by the **Native** American Heritage Commission) of Potential Native American Interments Located in Webb Tract. Specific mitigation and/or treatment in relation to the potential for burials will be dependent upon this negotiation. Mitigation and/or treatment typically include adoption of project design guidelines that minimize disturbance to sensitive areas as well as methods and guidance for: identifying intact interments; recovery, treatment, and reburial of interments; and the ultimate ownership of human remains and burial items. Mitigation and/or treatment also typically include methods and guidance in the event of an inadvertent discovery of human remains. ***Significance after Mitigation: less than significant*** **A3: Implement Mitigation Measure CUL-MM-1, components 1b, 1e, 1g, and 1h** ***Significance after Mitigation: significant and unavoidable***	
3.8 ENVIRONMENTAL JUSTICE	
EJ-1: Potential for Disproportionately High and Adverse Effects on Minority and Low-Income Populations in CT 3010 and the Bethel Island and Terminous CDPs.	
NAA: The increased intensity of agricultural operations and the for-fee hunting program that would be implemented under the No-Action Alternative would not result in substantial changes from existing conditions. Therefore, no disproportionately high and adverse effects on minority or low-income populations in CT 3010 or the Bethel Island or the Terminous CDPs would occur.	NE
A1, A2, A3: There is no minority population recognized by the U.S. Census Bureau in CT 3010, the Bethel Island CDP, or the Terminous CDP that comprises greater than 50% of the population, nor are any of these minority populations proportionally larger than in the county or the state. In addition, the percentage of the population below the poverty level in CT 3010, the Bethel Island CDP, and the Terminous CDP does not exceed 50% and is not meaningfully greater than of the percentage of the general population in the state living in poverty. Therefore, no	NE

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Table ES-1
Summary of Effects and Mitigation Measures

Effect		Significance
Mitigation		
	disproportionately high and adverse effects on minority or low-income populations in CT 3010, the Bethel Island CDP, or the Terminous CDP would occur.	
NAA: No mitigation is required. **A1, A2, A3:** No mitigation is required.		
EJ-2: Potential for Disproportionately High and Adverse Effects on Minority and Low-Income Populations in the Places of Use.		
NAA:	Under the No-Action Alternative, no water would be diverted onto the project islands for storage nor would it be exported to south-of-Delta groundwater banks or water districts for water supply. Therefore, no disproportionately high and adverse effects on minority or low-income populations in the places of use would occur.	NE
A1, A2:	There is no minority population recognized by the U.S. Census Bureau in the nine-county place-of-use area that comprise greater than 50% of the population, nor is any minority population proportionally larger than in the state. In addition, the population percentage in the nine-county place-of-use area below the poverty level does not exceed 50% and is not meaningfully greater than of the percentage of the general population in the state living in poverty. Therefore, no disproportionately high and adverse effects on minority or low-income populations in the places of use would occur.	NE
A3:	There are no minority populations recognized by the U.S. Census Bureau in the nine-county place-of-use area that comprise greater than 50% of the population or are proportionally larger than in the state. In addition, the population percentage in the nine-county area that is below the poverty level does not exceed 50% and is not meaningfully greater than of the percentage of the general population in the state living in poverty. Therefore, no disproportionately high and adverse effects on minority populations or low-income populations in the places of use would occur.	NE
NAA: No mitigation is required. **A1, A2, A3:** No mitigation is required.		
EJ-3: Potential for Disproportionately High and Adverse Effects on Minority and Low-Income Populations in CTs 39 and 40.01 and the Thornton Island CDP.		
NAA:	The increased intensity of agricultural operations and the for-fee hunting program that would be implemented under the No-Action Alternative would not result in substantial changes from existing conditions. Therefore, no disproportionately high and adverse effects on minority or low-income populations in the places of use would occur.	NE
A1, A2, A3:	Minority populations in CTs 39 and 40.01 and the Thornton CDP are greater than 50%, and the percentage of low-income populations in CT 39 is meaningfully greater than the state as a whole; therefore, the project would result in disproportionately high and adverse effects on	S

NAA (No-Action Alternative) A1 (Alternative 1) A2 (Alternative 2) A3 (Alternative 3) B (Beneficial)
NE (No effect) LTS (Less than significant) PS (Potentially significant) S (Significant) SU (Significant and unavoidable)

Table ES-1 Summary of Effects and Mitigation Measures	
Effect	Significance
Mitigation	
minority or low-income populations.	
NAA: No mitigation is required. **A1, A2:** **Aesthetics; Air Quality; Aquatic Resources; Land Use** No mitigation measures required. **Agricultural Resources** **Implement Mitigation Measure AG-MM-1** Cultural Resources **Implement Mitigation Measures CUL-MM-1, components 1a, 1b, 1c, and 1d, and CUL-MM-2.** **Socioeconomics** No feasible mitigation is available. **A3:** **Aesthetics; Agricultural Resources; Air Quality; Aquatic Resources; Land Use; Water Supply; Traffic and Transportation** No mitigation measures required. Cultural Resources **Implement Mitigation Measure CUL-MM-1, components 1a, 1b, 1c, 1d, 1e, 1g, and 1h, and CUL-MM-2** **Socioeconomics** No feasible mitigation is available. ***Significance after Mitigation: significant and unavoidable*** ***Cumulatively considerable and unavoidable***	

NAA (No-Action Alternative) A1 (Alternative 1) A2 (Alternative 2) A3 (Alternative 3) B (Beneficial)
NE (No effect) LTS (Less than significant) PS (Potentially significant) S (Significant) SU (Significant and unavoidable)

Table ES-1
Summary of Effects and Mitigation Measures

Effect	Significance
Mitigation	
3.9 FLOODPLAIN MANAGEMENT	
FM-1: Change in Long-Term Levee Stability on Reservoir Islands.	
NAA: The proposed levee improvements would not occur under the No-Action Alternative, and therefore long-term levee stability would likely decrease.	PS
A1, A2, A3: The proposed levee improvements have been designed to improve long-term stability, including maintenance to address settlement and sea-level rise.	LTS
NAA: No mitigation is required. **A1, A2, A3:** No mitigation is required.	
FM-2: Potential for Seepage from Reservoir Islands to Adjacent Islands.	
NAA: The proposed levee improvements would not be implemented; therefore, the potential for seepage would likely increase.	PS
A1, A2, A3: The proposed levee improvements have been designed to address seepage, including implementation of a Seepage Monitoring and Control System.	LTS
NAA: No mitigation is required. **A1, A2, A3:** No mitigation is required.	
FM-3: Potential for Wind and Wave Erosion on Reservoir Islands.	
NAA: Because the project would not be implemented, there would be no increased susceptibility to wind and wave erosion from water storage facilities.	NE
A1, A2, A3: The proposed levee improvements incorporate features designed to withstand wind and wave erosion.	LTS
NAA: No mitigation is required. **A1, A2, A3:** No mitigation is required.	

NAA (No-Action Alternative) A1 (Alternative 1) A2 (Alternative 2) A3 (Alternative 3) B (Beneficial)
NE (No effect) LTS (Less than significant) PS (Potentially significant) S (Significant) SU (Significant and unavoidable)

Table ES-1
Summary of Effects and Mitigation Measures

Effect	Significance
Mitigation	
FM-4: Potential for Erosion of Levee Toe Berms at Pump Stations and Siphon Stations on Reservoir Islands.	
NAA: The proposed facilities would not be implemented, therefore increased erosion of levees from the proposed facilities would not take place.	NE
A1, A2, A3: The proposed levee improvements have been designed to reduce erosion.	LTS
NAA: No mitigation is required. **A1, A2, A3:** No mitigation is required.	
FM-5: Change in Potential for Levee Failure on Project Islands During Seismic Activity.	
NAA: The proposed levee improvements would in not be implemented, and therefore levee stability during seismic activity would likely decrease.	PS
A1, A2, A3: The proposed levee improvements would increase levee stability during seismic activity.	LTS
NAA: No mitigation is required. **A1, A2, A3:** No mitigation is required.	
FM-6: Change in Long-Term Levee Stability on Habitat Islands.	
NAA: The proposed levee improvements would not occur and agriculture would intensify, and therefore long-term subsidence of the Habitat Islands would continue.	PS
A1, A2: The proposed levee improvements would increase long-term stability on the Habitat Islands.	LTS
NAA: No mitigation is required. **A1, A2:** No mitigation is required.	
3.10 HAZARDOUS WASTE AND MATERIALS	
HZ-1: **Potential Contamination of Stored Water by Contaminant Residues.**	
NAA: The proposed water storage facilities would not be constructed and thus there would be no mobilized contaminants to cause an adverse effect on Delta channel water quality from discharged water.	NE

NAA (No-Action Alternative) A1 (Alternative 1) A2 (Alternative 2) A3 (Alternative 3) B (Beneficial)
NE (No effect) LTS (Less than significant) PS (Potentially significant) S (Significant) SU (Significant and unavoidable)

Table ES-1
Summary of Effects and Mitigation Measures

	Effect	Significance
	Mitigation	
A1, A2, A3:	Water storage on the Reservoir Islands could mobilize soil contaminants from historical pollution sites. If the contaminant concentrations are high, mobilization of the dissolved fraction of the contaminants could cause an adverse effect on Delta channel water quality from discharged water.	S
NAA: No mitigation is required. **A1, A2, A3: Mitigation Measure HZ-MM-1: Conduct Assessments of Potential Contamination Sites and Remediate as Necessary.** The project applicant shall conduct site assessments at potential contamination sites, including sites associated with agricultural airstrip operations. If the results of a site assessment indicate that contamination is likely to mobilize into the stored water, the project applicant shall develop plans for site remediation. Such site assessments and remediation typically would be performed under the supervision of the Central Valley RWQCB. All required assessments and remediation shall be completed prior to the beginning of project water storage. ***Significance after Mitigation: less than significant*** ***Not cumulatively considerable with mitigation***		
HZ-2: Contamination of Delta Water by Agricultural Pollutants.		
NAA:	Fertilizers and pesticides used on agricultural land could contaminate agricultural drainwater that returns to Delta channels.	PS
A1, A2:	Fertilizers and pesticides currently used on agricultural land could contaminate agricultural drainwater that returns to Delta channels. Implementation of the project would have the beneficial effect of reducing these contaminants.	B, LTS
A3:	Fertilizers and pesticides currently used on agricultural land could contaminate agricultural drainwater that returns to Delta channels. Implementation of the project would have the beneficial effect of reducing these contaminants.	LTS
NAA: No mitigation is required. **A1, A2, A3:** No mitigation is required.		
HZ-3: **Aircraft Safety Hazards.**		
NAA:	The No-Action Alternative would not change operation of the airstrip or existing aircraft safety hazards.	NE
A1, A2, A3:	Project implementation would not substantially change operation of the airstrip or existing aircraft safety hazards.	LTS
NAA: No mitigation is required.		

NAA (No-Action Alternative) A1 (Alternative 1) A2 (Alternative 2) A3 (Alternative 3) B (Beneficial)
NE (No effect) LTS (Less than significant) PS (Potentially significant) S (Significant) SU (Significant and unavoidable)

Table ES-1
Summary of Effects and Mitigation Measures

Effect	Significance
Mitigation	
A1, A2, A3: No mitigation is required.	
HZ-4: Change in Mosquito Abatement Activities During Storage periods on the Reservoir Islands.	
NAA: Because the proposed water storage facilities would not be constructed, and because a somewhat different mix of agricultural crops is anticipated under the No-Action Alternative, this effect is beneficial and less than significant.	B, LTS
A1, A2, A3: During full-storage periods, mosquito production on the Reservoir Islands would be minimal. Deep, open-water habitats are poor mosquito breeding areas because the wave action generated over large water bodies disrupts the ability of larvae to penetrate the water surface and because vegetation necessary for egg laying and cover for larvae is lacking.	B, LTS
NAA: No mitigation is required. **A1, A2, A3:** No mitigation is required.	
HZ-5: Increase in Abatement Levels on the Habitat Islands and During Partial-Storage, Shallow-Storage, or Shallow Water-Wetland Periods on the Reservoir Islands.	
NAA: Because the proposed water storage facilities would not be constructed, an associated increase in mosquito production would not take place, and no effect would occur.	NE
A1, A2, A3: An increase in mosquito production would occur under partial-storage, shallow-storage, or shallow water-wetland conditions.	S
NAA: No mitigation is required. **A1, A2, A3: Mitigation Measure HZ-MM-2: Develop an Integrated Pest Management Program and Coordinate Project Activities with SJCMVCD and CCCMVCD.** The project applicant shall consult and coordinate with DFW, the Habitat Management Advisory Council (HMAC), SJCMVCD, and CCCMVCD during all phases of the project, including design, implementation, and operations. The project's CMP shall be updated in accordance with the Best Management Practices (BMPs) identified in the Central Valley Joint Venture's *Technical Guide to Best Management Practices for Mosquito Control in Managed Wetlands* (Kwasny et al. 2004) and other guidelines such as the *Best Management Practices for Mosquito Control on California State Properties* (California Department of Public Health 2008); and *Best Management Practices for Mosquito Control in California* (California Department of Public Health and Mosquito and Vector Control Association of California 2010). The project applicant shall be responsible for coordination with SJCMVCD and CCCMVCD regarding mosquito control measures for the Reservoir Islands; and the project applicant, DFW, and HMAC shall be responsible for coordination regarding the Habitat Islands. Consultation and coordination with SJCMVCD and CCCMVCD shall include the development of an integrated pest management (IpM) plan for mosquitoes that follows the guidelines of the *Best Management practices for Mosquito Control in Managed Wetlands* (Kwasny et al. 2004) and the other guidelines listed above, and shall contain a continual maintenance program. An example list of the types of BMPs that may be included in the project's IpM plan is provided below.	

NAA (No-Action Alternative)	A1 (Alternative 1)	A2 (Alternative 2)	A3 (Alternative 3)	B (Beneficial)
NE (No effect)	LTS (Less than significant)	PS (Potentially significant)	S (Significant)	SU (Significant and unavoidable)

Table ES-1
Summary of Effects and Mitigation Measures

Effect	Significance
Mitigation	

Wetland Design Features

- Design water delivery and drainage systems to allow for rapid manipulation of water levels within the wetlands. This could include construction of swales sloped from inlet to outlet to allow the majority of the wetland to be drawn down quickly, and independent inlets and outlets for each wetland unit.
- Ensure that shorelines, which may be vacillating, do not isolate from the main body of water sections that create pockets where mosquitoes would be free of competition and predation.
- Create basins with a high slope index, variable depths, and shallow and deep regions that provide open water zones adjacent to shallow vegetated zones.
- Install cross-levees to facilitate more rapid flood-up.
- Excavate deep channels or basins to maintain permanent water areas (deeper than 2.5 feet) within a portion of seasonal wetlands to provide year-round habitat for mosquito predators that can inoculate seasonal wetlands when flooded.

Water Management Practices

- Delay flooding of some wetland units until later in the fall, and delay flooding units with greatest historical mosquito production and/or those closest to urban areas.
- Flood wetland units as quickly as possible.
- Ensure constant flow of water into wetlands to reduce water fluctuation from evaporation, transpiration, outflow, and seepage.
- Flood wetland as deep as possible at initial flood-up.
- Flood wetlands with water sources containing mosquitofish or other invertebrate predators. Water from permanent ponds can be used to passively introduce mosquito predators.
- Drain any irrigation water into locations with mosquito predators as opposed to adjacent seasonal wetland or dry fields.
- Avoid “pulses” of increased organic load to inhibit episodic fluctuation in mosquito population numbers during the months of April–October.
- Use flood and drain techniques as a method to eliminate larvae.

Vegetation Management Practices

- Avoid continuous stands of emergent vegetation. These stands generate microhabitats that support mosquito productivity by providing refuge from predation, accumulation and concentration of organic foods, and interference with water circulation and wave action.
- Maintain aquatic vegetation in islands surrounded by deeper water. This breaks up the uniform microhabitat and provides variable physical and biological constraints on the mosquito population.
- Avoid plants that tend to mat the water surface. Promote plants in islands such as bulrush and cattails, which function as substrate for mosquito predators. Plants such as sago pondweed for example, are completely submergent and contribute little to mosquito refuge while providing good predator refuge and even waterfowl food.

NAA (No-Action Alternative) A1 (Alternative 1) A2 (Alternative 2) A3 (Alternative 3) B (Beneficial)
NE (No effect) LTS (Less than significant) PS (Potentially significant) S (Significant) SU (Significant and unavoidable)

Table ES-1
Summary of Effects and Mitigation Measures

Effect	Significance
Mitigation	
Wetlands Maintenance ▸ Maintain levees, water control structures, and ditches regularly. ▸ Manage vegetation through periodic harvesting, thinning, disking, or burning to maintain open areas. ▸ Remove silt and detritus periodically to maintain regular wetland depth. **Biological Controls** ▸ Encourage on-site predator populations by providing permanent water sources for mosquitofish. Such “dry season” predator reservoirs should be 18 inches or more in depth to reduce predation of mosquitofish by herons and egrets. ▸ Avoid use of broad spectrum insecticides that not only kill mosquitoes, but also eliminate their natural predators. ▸ Ensure that mosquitofish have access to each basin. **Consultation with CCCMVCD and SJCMVCD** ▸ Consult with CCCMVCD and SJCMVCD during the project design phase to incorporate design and operational elements of the Reservoir and Habitat Islands to reduce the mosquito production potential of the project. ▸ Consult with CCCMVCD and SJCMVCD on the timing of wetland flooding. ▸ Regularly consult with SJCMVCD and CCCMVCD to identify mosquito management problems, mosquito monitoring and abatement procedures, and opportunities to adjust operations to reduce mosquito production during problem periods. ▸ Develop an access plan with CCCMVCD and SJCMVCD to allow for monitoring and control of mosquito populations on the project islands. ▸ Work with CCCMVCD and SJCMVCD to understand pesticides used for mosquito abatement, and their costs and environmental effects. ▸ If it is necessary for SJCMVCD and CCCMVCD to increase mosquito monitoring and control programs beyond pre-project levels, the project applicant shall share costs with CCCMVCD and SJCMVCD or otherwise participate in implementing mosquito abatement programs. ***Significance after Mitigation: less than significant*** ***Not cumulatively considerable with mitigation***	
HZ-6: Increase in Potential Exposure of People to Wildlife Species that Transmit Diseases.	
NAA: Transmission of wildlife-transmitted diseases such as Lyme disease, bubonic plague, and rabies is not considered a substantial risk to public health in the Delta.	LTS
A1, A2: The potential for transmission of wildlife-transmitted diseases such as Lyme disease, bubonic plague, and rabies to humans would not change following project implementation.	NE

NAA (No-Action Alternative) A1 (Alternative 1) A2 (Alternative 2) A3 (Alternative 3) B (Beneficial)
NE (No effect) LTS (Less than significant) PS (Potentially significant) S (Significant) SU (Significant and unavoidable)

Table ES-1
Summary of Effects and Mitigation Measures

Effect		Significance
Mitigation		
A3:	Wildlife species that could transmit diseases to humans are not expected to be present on the project islands under Alternative 3 because their habitats would be reduced substantially as a result of increased water storage on all four islands.	NE
NAA: No mitigation is required. **A1, A2, A3:** No mitigation is required.		
3.11 HYDROLOGY AND WATER QUALITY		
WQ-1: Hydrodynamics Effects.		
NAA:	The proposed water diversions from and releases to Delta channels would not occur. Hydrodynamics effects under continued and intensified agricultural operations would not be substantially different from existing conditions.	LTS
WQ-1: Hydrodynamic Effects on Local Channel Velocities and Stages From Project Diversions and Discharges.		
A1, A2, A3:	Modeling results indicate that project effects on local channel velocities and stages would be small and within the range of conditions normally encountered in the Delta.	LTS
NAA: No mitigation is required. **A1, A2, A3:** No mitigation is required.		
WQ-2: Salinity increase.		
NAA:	Agricultural operations would continue to use irrigation water, and the existing gradual buildup of salt in agricultural soils would continue. Water drained from islands with continued agriculture would have increasingly higher salinities over time but would not be substantially different from existing conditions.	LTS
WQ-2: Hydrodynamic Effects on Net Channel Flows.		
A1, A2, A3:	Modeling results indicate that project effects on net channel flows would be small and within the range of conditions normally encountered in the Delta.	LTS
NAA: No mitigation is required. **A1, A2, A3:** No mitigation is required.		

NAA (No-Action Alternative) A1 (Alternative 1) A2 (Alternative 2) A3 (Alternative 3) B (Beneficial)
NE (No effect) LTS (Less than significant) PS (Potentially significant) S (Significant) SU (Significant and unavoidable)

Table ES-1
Summary of Effects and Mitigation Measures

	Effect	Significance
	Mitigation	
Potentially Significant Cumulative Hydrodynamic Effects on Net Channel Flows.		
Mitigation Measure CM-WQ-1: Operate the DW Project to Prevent Unacceptable Hydrodynamic Effects in the Middle River and Old River Channels During Flows that are Higher than Historical Flows.	USGS and DWR tidal flow measurements (i.e., velocities and stages) in south Delta channels, as well as tidal hydrodynamic model simulations, should be used to determine the effects of project operations, and project operations should be controlled to prevent unacceptable **hydrodynamic** conditions in south Delta channels. Measures that may be used to prevent unacceptable hydrodynamic effects include establishing minimum tidal stages and maximum channel velocities. Project discharges would be reduced or eliminated during these extreme tidal conditions. ***Not cumulatively considerable with mitigation***	
WQ-3: Elevated DOC Concentrations.		
NAA:	Agricultural drainage water from the project islands has higher concentrations of DOC as compared to irrigation water that is applied to the islands. Water drained from the islands with continued and intensified agriculture would potentially have increasingly higher DOC concentrations over time but would not be substantially different from existing conditions.	LTS
WQ-3: Salinity Increase at Chipps Island.		
A1, A2:	Because the simulated project operations for this SEIS require a minimum outflow of about 11,400 cfs (i.e., X2 downstream of Chipps Island) during diversions, the simulated EC changes at Chipps Island demonstrate that the project would meet the WQMP criteria.	LTS
A3:	The simulated project operations for this SEIS require a minimum outflow of about 11,400 cfs (i.e., X2 downstream of Chipps Island) during diversions. Because the project is required to comply with operational restrictions contained in the WQMP, this effect is less than significant.	LTS
NAA:	No mitigation is required.	
A1, A2, A3:	No mitigation is required.	
WQ-4: Increased Methylmercury Loading.		
NAA:	Continued and intensified agricultural activities would result in continued and potentially somewhat higher methylmercury production, but loading would not be substantially different from existing conditions.	LTS
WQ-4: Salinity Increase at Emmaton.		
A1, A2:	Because the simulated project operations for this SEIS require a minimum outflow of about 11,400 cfs during diversions, the simulated EC changes at Emmaton demonstrate that the project would meet the WQMP requirements. Diversions would only occur in the months of December-March when there are no established salinity objectives at Emmaton.	LTS

NAA (No-Action Alternative) A1 (Alternative 1) A2 (Alternative 2) A3 (Alternative 3) B (Beneficial)
NE (No effect) LTS (Less than significant) PS (Potentially significant) S (Significant) SU (Significant and unavoidable)

Table ES-1
Summary of Effects and Mitigation Measures

Effect		Significance
Mitigation		
A3:	There are essentially no salinity intrusion effects at Emmaton for outflow greater than 10,000 cfs. The simulated project operations for this SEIS require a minimum outflow of about 11,400 cfs during diversions, the simulated EC changes at Emmaton would be small, and project diversions would only occur in the months of December-March when there are no established salinity objectives at Emmaton.	LTS
NAA: No mitigation is required.		
A1, A2, A3: No mitigation is required.		
WQ-5: Increase in Pollutant Loading in Delta Channels Associated with Recreational Boating.		
NAA:	The No-Action Alternative would not entail the construction of new recreational facilities.	LTS
WQ-5: Salinity Increase at Jersey Point.		
A1, A2:	Because the simulated project operations for this SEIS require a minimum outflow of about 11,400 cfs during diversions, the simulated EC changes at Jersey Point demonstrate that the project would meet the WQMP requirements. Diversions would occur only in the months of December–March when there are no established salinity objectives at Jersey Point.	LTS
A3:	There are essentially no salinity intrusion effects at Jersey Point for outflow greater than 10,000 cfs. The simulated project operations for this SEIS require a minimum outflow of about 11,400 cfs during diversions, the simulated EC changes at Jersey Point would be small, and project diversions would only occur in the months of December-March when there are no established salinity objectives at Jersey Point.	LTS
NAA: No mitigation is required.		
A1, A2, A3: No mitigation is required.		
WQ-6: Salinity Increase at Delta Export Facilities.		
A1, A2:	Because the simulated project operations for this SEIS require a minimum outflow of about 11,400 cfs during diversions, the simulated chloride changes at Delta export facilities demonstrate that the project would meet the WQMP requirements. Diversions would occur only in the months of December–March when the minimum chloride objective would be 150 mg/l.	LTS
A3:	There are essentially no salinity intrusion effects at Delta export facilities for outflow greater than 10,000 cfs. Because project operations would maintain a minimum Delta outflow of about 11,400 cfs, the effect of Alternative 3 on Delta salinity would be small, and this effect is less than significant.	LTS
A1, A2, A3: No mitigation is required.		

NAA (No-Action Alternative) A1 (Alternative 1) A2 (Alternative 2) A3 (Alternative 3) B (Beneficial)
NE (No effect) LTS (Less than significant) PS (Potentially significant) S (Significant) SU (Significant and unavoidable)

Table ES-1
Summary of Effects and Mitigation Measures

Effect	Significance
Mitigation	
WQ-7: Beneficial Salinity Reductions at Delta Export Facilities.	
A1, A2, A3: Because the simulated project operations for this SEIS simulate the release of project storage water in October and November in years when the water could not be exported for delivery to designated places of use or to the groundwater banks, there are substantial increases in Delta outflow that would reduce salinities at export facilities.	B
A1, A2, A3: No mitigation is required.	
WQ-8: Elevated DOC Concentrations at Delta Export Facilities.	
A1, A2: Discharges from the project islands may have relatively high DOC concentrations that may substantially increase DOC concentrations in Delta exports. However, implementation of the WQMP would use monitoring and possible restrictions on storage island releases to minimize DOC effects on water quality at the urban intakes. Operational criteria of more than 1 mg/l TOC net increase or exceeding the 4 mg/l TOC threshold were established in the WQMP. Adherence to the WQMP ensures that this effect is less than significant.	LTS
A3: Discharges from the project islands may have relatively high DOC concentrations that may substantially increase DOC concentrations in Delta exports. However, implementation of the WQMP requires monitoring and restrictions on storage island releases to minimize DOC effects on water quality at the urban intakes. Operational criteria of more than 1 mg/l TOC net increase or exceeding the 4 mg/l TOC threshold were established in the WQMP. Because the project is required to comply with the WQMP criteria, this effect is less than significant.	LTS
A1, A2, A3: No mitigation is required.	
WQ-9: Increased Methylmercury Loading in the Delta.	
A1, A2, A3: The adopted mercury TMDL limits for methylmercury loading in the Delta require that there be no increase in methylmercury load in the central Delta. Any project that could increase methylmercury loading above existing conditions would cause a violation of the TMDL amendment to the Basin Plan. Most of the project area falls in the central Delta. Wetlands and open water of the Delta may produce slightly more methylmercury than agricultural practices on peat soils.	PS
A1, A2, A3: Mitigation Measure WQ-MM-1: Follow Guidelines from Proposed Delta TMDL for Methylmercury. The 2011 TMDL Basin Plan amendments for mercury contain requirements for organizations that propose to create wetlands within the Delta. The project applicant will follow the requirements of the TMDL, which include: ▸ Participate in a management effort to evaluate and minimize health risks associated with eating fish contaminated with mercury (Wood et al. 2010b:BPA-15, BPA-16; Central Valley Regional Water Quality Board 2011). ▸ For phase 1 of the TMDL, participate in a monitoring program to evaluate methylmercury loading and procedures to minimize methylmercury loading from wetlands (Wood et al. 2010b:BPA-3; Central Valley Regional Water Quality Board 2011).	

NAA (No-Action Alternative)	A1 (Alternative 1)	A2 (Alternative 2)	A3 (Alternative 3)	B (Beneficial)
NE (No effect)	LTS (Less than significant)	PS (Potentially significant)	S (Significant)	SU (Significant and unavoidable)

Table ES-1
Summary of Effects and Mitigation Measures

Effect	Significance
Mitigation	
▸ For phase 2 of the TMDL, implement approved methylmercury control actions. These potential actions and their effectiveness are uncertain at this time. Other possible mitigation might involve an offset program (Wood et al. 2010b:ES-3, BPA-13; Central Valley Regional Water Quality Board 2011). **Mitigation Measure WQ-MM-2: Incorporate Mercury Methylation Control Measures in Wetland Design.** Certain actions such as permanent inundation or fall/winter inundation may help to reduce the formation of methylmercury in wetlands. As phase 1 of the TMDL is being implemented, knowledge about procedures to reduce methylmercury formation may improve. The project applicant would use any feasible procedures to reduce methyl mercury formation on the reservoir or habitat islands. This could include modifying the final CMP design or making changes later in response to new information. Proposed techniques (Wood et al. 2010a:31; Wood et al. 2010b:108) include taking the following actions: ▸ modifying wetland design (e.g., depth, period of inundation, and vegetation), ▸ reducing discharge of water with high concentrations of methylmercury, and trapping sediment with actions such as creating settling basins or planting appropriate types of vegetation (in order to reduce discharge of methylmercury attached to sediment). ***Significance after Mitigation: less than significant***	
WQ-10: Changes in Other Water Quality Variables in Delta Channel Receiving Waters.	
A1, A2, A3: Discharges of stored water from project islands may adversely affect channel water quality near the discharge locations. The FOC for fish protection identified discharge limits for temperature and DO, and the WQMP includes monitoring and adjustment of project operations for turbidity and other variables. The project is required to implement the FOC as part of the USFWS and NMFS BOs and adhere to the WQMP.	LTS
A1, A2, A3: No mitigation is required.	
WQ-11: Water Pollution Caused by Construction Activities.	
A1, A2, A3: Construction activities could introduce contaminants into adjacent water bodies. Primary construction-related contaminants that could reach groundwater or surface water consist of increased sediment and oil and grease. Because the project incorporates effective BMPs to reduce water pollution caused by construction, this effect is less than significant.	LTS
A1, A2, A3: No mitigation is required.	
WQ-12: Increase in Pollutant Loading in Delta Channels Associated with Recreational Boating.	
A1, A2, A3: No new recreational facilities would be constructed as part of the project. Occasional use of the new boat docks that would be required for project operations and maintenance would not result in a substantial increase in pollutant loading in Delta channels.	LTS
A1, A2, A3: No mitigation is required.	

NAA (No-Action Alternative) A1 (Alternative 1) A2 (Alternative 2) A3 (Alternative 3) B (Beneficial)
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Table ES-1
Summary of Effects and Mitigation Measures

Effect		Significance
Mitigation		
3.12 LAND USE		
LU-1: Displacement of Residences and Structures on the Project Islands.		
NAA:	No project-related facilities would be constructed, and there would be no displacement of residences or other structures from agricultural activities.	NE
A1, A2, A3:	Land on all four project islands is held under short-term farm leases that contemplate eventual conversation to water storage.	LTS
NAA: No mitigation is required. **A1, A2, A3:** No mitigation is required.		
LU-2: Displacement of Property Owners on the Project Islands.		
NAA:	No project-related facilities would be constructed, and thus there would be no displacement of occupants on the project islands.	NE
A1, A2:	Housing opportunities in the local area are considered sufficient for those affected to be housed.	LTS
A3:	Housing opportunities in the local area are considered sufficient for those affected to be housed; and the affected landowners on Bouldin Island and Holland Tract have been or would be compensated for their property as willing sellers.	LTS
NAA: No mitigation is required. **A1, A2, A3:** No mitigation is required.		
LU-3: Conflicts with Adjacent Land Uses.		
NAA:	No project-related facilities would be constructed, and thus there would be no conflicts with adjacent land uses.	NE
A1, A2, A3:	Project implementation would not result in substantial conflicts with or create nuisances that could affect or impair adjacent land uses.	LTS
NAA: No mitigation is required. **A1, A2, A3:** No mitigation is required.		

NAA (No-Action Alternative) A1 (Alternative 1) A2 (Alternative 2) A3 (Alternative 3) B (Beneficial)
NE (No effect) LTS (Less than significant) PS (Potentially significant) S (Significant) SU (Significant and unavoidable)

Table ES-1
Summary of Effects and Mitigation Measures

Effect	Significance
Mitigation	
LU-4: Consistency with Zoning and General Plan Designations and Delta Protection Commission Land Use Plan Principles.	
NAA: No project-related facilities would be constructed, and thus there would be no inconsistency with zoning and general plan designations or DPC land use plan principles.	NE
A1, A2, A3: While certain aspects of the project would be consistent with existing land use and zoning designations, the project would be inconsistent with Contra Costa County and DPC agricultural principles to protect and encourage agricultural uses in the Delta.	S
NAA: No mitigation is required. **A1, A2, A3:** No feasible mitigation measures are available. ***Significance after Mitigation: significant and unavoidable*** ***Cumulatively significant and unavoidable***	
3.13 NOISE	
NOI-1: Exposure of Sensitive Receptors to Construction-Related Noise and Groundborne Vibration.	
NAA: Because the project would not be implemented, there would no exposure of sensitive receptors to construction-related noise or groundborne vibration.	NE
A1, A2, A3: Project-related construction activities that occur during the daytime are exempt from local noise standards. Project-related construction activities that occur between the hours of 8 p.m. and 7 a.m., if any, would represent an adverse effect on noise-sensitive land uses.	S
NAA: No mitigation is required. **A1, A2, A3: Mitigation Measure NOI-MM-1: Limit Construction Hours and Comply with all Applicable Local Noise Standards.** In addition to complying with all applicable local noise standards, the project applicant will limit construction activities that create noise near sensitive use areas to the hours between 7:00 a.m. and 8:00 p.m. ***Significance after Mitigation: less than significant*** ***Not cumulatively considerable***	
NOI-2: Exposure of Sensitive Receptors to Operational Traffic and Recreation Noise.	
NAA: Operational noise under the No-Action Alternative would not result in substantial changes in the noise levels.	LTS
A1, A2, A3: Project-related operational traffic would not result in a doubling (i.e., a 5 dBA increase) of noise along the local roadway network, and since no new recreational facilities would be constructed, there would be no project-related increase in recreation noise.	LTS

NAA (No-Action Alternative) A1 (Alternative 1) A2 (Alternative 2) A3 (Alternative 3) B (Beneficial)
NE (No effect) LTS (Less than significant) PS (Potentially significant) S (Significant) SU (Significant and unavoidable)

Table ES-1 Summary of Effects and Mitigation Measures		
	Effect	Significance
	Mitigation	
NAA: No mitigation is required. **A1, A2, A3:** No mitigation is required.		
NOI-3: Exposure of Sensitive Receptors to Operational Equipment Noise.		
NAA:	The project would not be implemented, and therefore would be no discharge pump stations that would potentially generate noise above county standards.	NE
A1, A2, A3:	Discharge pump stations on the four project islands would not be audible over the existing ambient noise at any noise-sensitive land uses in the project vicinity.	LTS
NAA: No mitigation is required. **A1, A2, A3:** No mitigation is required.		
NOI-4: Exposure of Sensitive Receptors to Operational Noise from Ongoing Maintenance and Habitat Conservation Activities.		
NAA:	Because the project would not be implemented, there would be no maintenance and habitat conservation activities that would potentially generate noise above county standards.	NE
A1, A2, A3:	Ongoing maintenance and habitat conservation activities are expected to be infrequent and would occur at a distance of approximately 2.5 miles from the nearest sensitive receptor.	LTS
NAA: No mitigation is required. **A1, A2, A3:** No mitigation is required.		
3.14 PARKS AND RECREATION		
REC-1: Increase in Hunting Opportunities on the Project Islands.		
NAA:	Annual hunting recreation use-days would increase under the No-Action Alternative.	B, LTS
A1, A2, A3:	Waterfowl habitat on Reservoir and Habitat Islands would increase, and therefore annual hunting recreation use-days would also increase.	B, LTS
NAA: No mitigation is required. **A1, A2, A3:** No mitigation is required.		

NAA (No-Action Alternative) A1 (Alternative 1) A2 (Alternative 2) A3 (Alternative 3) B (Beneficial)
NE (No effect) LTS (Less than significant) PS (Potentially significant) S (Significant) SU (Significant and unavoidable)

Table ES-1
Summary of Effects and Mitigation Measures

Effect		Significance
Mitigation		
REC-2: Change in Regional Hunter Success Outside the Project Area.		
NAA:	There would be no redistribution of waterfowl populations to the Habitat Islands, and thus there would be no effect on the availability of waterfowl hunting outside of the project islands.	NE
A1, A2:	Redistribution of waterfowl populations to the Habitat Islands could affect the availability of waterfowl hunting outside of the project islands.	LTS
A3:	The proposed CMP would not be created, waterfowl would likely not redistribute to the project islands, and therefore hunter success outside the project area likely would increase.	LTS
NAA: No mitigation is required. **A1, A2, A3:** No mitigation is required.		
REC-3: Increase in Recreation Use-Days for Boating in the Delta.		
NAA:	The No-Action Alternative would not result in a substantial increase in recreational boating activities in Delta waterways.	LTS
A1, A2, A3:	New project-related recreational facilities would not be constructed; therefore, the project would not provide an increase in boat-related recreation opportunities in the Delta.	NE
NAA: No mitigation is required. **A1, A2, A3:** No mitigation is required.		
REC-4: Change in the Quality of the Recreational Boating Experience in Delta Channels.		
NAA:	The continuation of agricultural activities and proposed for-fee hunting program under the No-Action Alternative would have no effect on the quality of recreational boating experiences in Delta channels.	NE
A1, A2, A3:	No new project-related recreation facilities would be constructed; therefore, the project would not change the quality of the recreational boating experience in Delta channels.	NE
NAA: No mitigation is required. **A1, A2, A3:** No mitigation is required.		

NAA (No-Action Alternative) A1 (Alternative 1) A2 (Alternative 2) A3 (Alternative 3) B (Beneficial)
NE (No effect) LTS (Less than significant) PS (Potentially significant) S (Significant) SU (Significant and unavoidable)

Table ES-1
Summary of Effects and Mitigation Measures

Effect	Significance
Mitigation	
REC-5: Increase in Recreation Use-Days for Other Recreational Uses in the Delta.	
NAA: The continuation of agricultural activities under the No-Action Alternative would have no effect on recreation use-days for other recreational uses in the Delta.	NE
A1, A2, A3: No new project-related recreational facilities would be constructed; therefore, the project would not result in an increase in recreation use-days for other recreational activities in the Delta.	NE
NAA: No mitigation is required. **A1, A2, A3:** No mitigation is required.	
3.15 PUBLIC SERVICES	
PS-1: Increase in Demand for Law Enforcement Services on the Project Islands.	
NAA: Increasing the intensity of agricultural activities would not result in an increase in the demand for police services.	NE
A1, A2, A3: Operation of proposed water diversion and storage facilities would not increase the demand for law enforcement services.	NE
NAA: No mitigation is required. **A1, A2, A3:** No mitigation is required.	
PS-2: Increase in Demand for Fire Protection Services on the Project Islands.	
NAA: Increasing the intensity of agricultural activities would not result in an increase in the demand for fire protection services.	NE
A1, A2, A3: Operation of the proposed water diversion and storage facilities would not increase the demand for fire protection services.	NE
NAA: No mitigation is required. **A1, A2, A3:** No mitigation is required.	

NAA (No-Action Alternative) A1 (Alternative 1) A2 (Alternative 2) A3 (Alternative 3) B (Beneficial)
NE (No effect) LTS (Less than significant) PS (Potentially significant) S (Significant) SU (Significant and unavoidable)

Table ES-1 Summary of Effects and Mitigation Measures		
	Effect	Significance
	Mitigation	
3.16 SOCIOECONOMICS		
SOCIO-1: Temporary and Short-Term Increase in Employment and Personal Income Resulting from Construction-Related Activities.		
NAA:	The No-Action Alternative would not result in construction-related jobs and personal income.	NE
A1, A2:	Implementation of Alternatives 1 and 2 would result in temporary and short-term increases in employment and personal income in Contra Costa and San Joaquin Counties from construction-related activities. Construction of proposed water storage facilities would generate an estimated 344 direct, indirect, and induced jobs and an estimated $21.5 million in personal income. These new jobs are expected to provide temporary, short-term employment opportunities to many unemployed workers and spending related to construction would result in substantial local economic activity in the region. Because construction of water storage facilities would result in a temporary and short-term increase in construction-related employment and personal income, the economic effects in Contra Costa and San Joaquin Counties resulting from project construction are beneficial and less than significant.	B, LTS
A3:	Implementation of Alternative 3 would result in temporary and short-term increases in employment and personal income in Contra Costa and San Joaquin Counties from construction-related activities. Construction of proposed water storage facilities would generate an estimated total of 732 direct, indirect, and induced jobs and an estimated $45.8 million in personal income. These new jobs are expected to provide temporary employment opportunities to many unemployed workers and spending related to construction would result in substantial local economic activity in the region. Because construction of water storage facilities would result in a temporary and short-term increase in construction-related employment and personal income, the economic effects in Contra Costa and San Joaquin Counties resulting from project construction are beneficial and less than significant.	B, LTS
NAA: No mitigation is required. **A1, A2, A3:** No mitigation is required.		
SOCIO-2: Temporary and Short-Term Increase in Population and Housing Demand Resulting from Construction of Water Storage Facilities.		
NAA:	Under the No-Action Alternative, no construction workers would be needed and the population and housing conditions and labor force characteristics are expected to continue following current trends.	NE
A1, A2, A3:	Implementation of Alternatives 1, 2, or 3 would result in temporary and short-term increases in population and housing demand in Contra Costa and San Joaquin Counties as a result of construction of water storage facilities. Because workers serving the project could be expected to come from nearby communities and cities in Contra Costa and San Joaquin Counties, neither substantial population growth nor an increase in housing demand in the region is anticipated as a result of these jobs.	LTS
NAA: No mitigation is required.		

NAA (No-Action Alternative)	A1 (Alternative 1)	A2 (Alternative 2)	A3 (Alternative 3)	B (Beneficial)
NE (No effect)	LTS (Less than significant)	PS (Potentially significant)	S (Significant)	SU (Significant and unavoidable)

Table ES-1
Summary of Effects and Mitigation Measures

Effect		Significance
Mitigation		
A1, A2, A3: No mitigation is required.		
SOCIO-3: Temporary and Short-Term Increase in State and Local Sales Tax Revenues from Construction-Related Personal Income and Purchases.		
NAA:	Under the No-Action Alternative, there would be no construction-related increase in personal income and purchases that would increase State and local sales tax revenues.	NE
A1, A2, A3:	Implementation of Alternatives 1, 2, or 3 would result in a substantial increase in total personal income (direct, indirect, and induced) during the construction period. This additional income, in combination with the construction-related purchases in Contra Costa and San Joaquin Counties, would result in a substantial increase in state and local sales tax revenues from increased consumer spending in nearby cities and both counties.	B, LTS
NAA: No mitigation is required. **A1, A2, A3:** No mitigation is required.		
SOCIO-4: Permanent Effects on Employment and Personal Income Resulting from Operation and Maintenance of Water Storage Facilities.		
NAA:	The No-Action Alternative would not result in project-related jobs and personal income or the loss of agricultural-related jobs and personal income.	NE
A1, A2:	Alternatives 1 and 2 would generate an estimated 222 permanent jobs and a projected $12.1 million in annual, permanent income from operation and maintenance of water storage facilities. This gain in income would partially offset the loss of an estimated 99 jobs and $2.7 million in personal income currently generated by agricultural operations. Implementation of Alternatives 1 and 2 would thus result in the projected net gain of an estimated 123 jobs and approximately $9.4 million in annual income in San Joaquin and Contra Costa Counties. The increase in employment and personal income from operation and maintenance of water storage facilities is a beneficial and less-than-significant effect. However, the loss of jobs and personal income to farmworkers and other workers in agriculture-related industries is a significant effect.	S
A3:	Alternative 3 would generate an estimated 258 permanent jobs and a projected $14.1 million in annual, permanent income from operation and maintenance of water storage facilities. This gain in income would partially offset the loss of an estimated 192 jobs and $5.2 million in personal income currently generated by agricultural operations. Implementation of Alternative 3 would thus result in the projected net gain of 66 jobs and approximately $8.9 million in annual income in San Joaquin and Contra Costa Counties. The increase in employment and personal income from operation and maintenance of water storage facilities is a beneficial and less-than-significant effect.	S
NAA: No mitigation is required. **A1, A2, A3:** No feasible mitigation is available.		

NAA (No-Action Alternative)	A1 (Alternative 1)	A2 (Alternative 2)	A3 (Alternative 3)	B (Beneficial)
NE (No effect)	LTS (Less than significant)	PS (Potentially significant)	S (Significant)	SU (Significant and unavoidable)

Table ES-1
Summary of Effects and Mitigation Measures

Effect	Significance
Mitigation	
Significance after Mitigation: significant and unavoidable ***Cumulatively considerable and unavoidable***	
SOCIO-5: Permanent Increase in Population and Housing Demand Resulting from Operation and Maintenance of Water Storage Facilities.	
NAA: The No-Action Alternative would not permanently increase population and housing demand and the population and housing conditions and labor force characteristics are expected to continue following current trends.	NE
A1, A2, A3: Implementation of Alternatives 1 and 2 would permanently increase population and housing demand in Contra Costa and San Joaquin Counties as a result of operation and maintenance of water storage facilities. Because the operational and maintenance workers serving the project could be expected to come from nearby communities and cities in Contra Costa and San Joaquin Counties, neither substantial population growth nor an increase in housing demand in the region is anticipated as a result of these jobs.	LTS
NAA: No mitigation is required. **A1, A2, A3:** No mitigation is required.	
SOCIO-6: Permanent Increases in Spending, Income, and Employment Generated by Recreational Activities on the Project Islands.	
NAA: Under the No-Action Alternative, an intensive for-fee hunting program would be operated on the project islands, which would generate spending, income, and employment in Contra Costa and San Joaquin Counties.	LTS
A1, A2, A3: Implementation of Alternatives 1, 2, or 3 would not include construction of recreational facilities.	NE
NAA: No mitigation is required. **A1, A2, A3:** No mitigation is required.	
SOCIO-7: Permanent Effects on Agricultural Economics from Idling of Crops on the Project Islands.	
NAA: Under the No-Action Alternative, no loss of crop acreage, crop production value, or value added would occur that could affect agricultural economics in Contra Costa and San Joaquin Counties and the region.	NE
A1, A2: In total, implementation of Alternatives 1 and 2 would result in in a loss of an estimated 14,805 acres of crops, $17.4 million in production value, and $8.0 million in value added.	S

NAA (No-Action Alternative) A1 (Alternative 1) A2 (Alternative 2) A3 (Alternative 3) B (Beneficial)
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Table ES-1 Summary of Effects and Mitigation Measures		
	Effect	Significance
	Mitigation	
A3:	In total, implementation of Alternative 3 would result in in an estimated loss of 17,761 acres of crops, $18.8 million in production value, and $9.0 million in value added.	S
NAA: No mitigation is required. **A1, A2, A3:** No feasible mitigation is available. ***Significance after Mitigation: significant and unavoidable*** ***Cumulatively considerable and unavoidable***		
SOCIO-8: Increased Profits for Landowners of the Project Islands Resulting from the Sale of Project Water.		
NAA:	Under the No-Project Alternative, there would be no sale of project water that would increase profits for landowners of the project islands.	NE
SOCIO-8: Permanent Increase in State and Local Sales Tax Revenues from Personal Income and Purchases.		
A1, A2, A3:	Implementation of Alternatives 1, 2, or 3 would result in a substantial increase in total personal income (direct, indirect, and induced) that would result in a substantial increase in state and local sales tax revenues from increased consumer spending in nearby cities and both counties.	B, LTS
NAA: No mitigation is required. **A1, A2, A3:** No mitigation is required.		
SOCIO-9: Permanent Increase in State and Local Sales Tax Revenues from Personal Income and Purchases.		
NAA:	Under the No-Action Alternative, there would be no construction-related increase in personal income and purchases that would increase state and local sales tax revenues.	NE
SOCIO-9: Increases in Property Taxes and Values Associated with Profits from the Sale of Project Water.		
A1, A2, A3:	Water-transfer payments presumably would increase average economic returns, thereby increasing property values. Subsequently, reappraisals of farm properties for property tax purposes would occur resulting in increases property tax revenues.	B, LTS
NAA: No mitigation is required. **A1, A2, A3:** No mitigation is required.		

NAA (No-Action Alternative) A1 (Alternative 1) A2 (Alternative 2) A3 (Alternative 3) B (Beneficial)
NE (No effect) LTS (Less than significant) PS (Potentially significant) S (Significant) SU (Significant and unavoidable)

Table ES-1
Summary of Effects and Mitigation Measures

Effect	Significance
Mitigation	
SOCIO-10: Increases in Property Taxes and Values Associated with Profits from the Sale of Project Water.	
NAA: Under the No-Action Alternative, there would be no increases in property tax revenues to Contra Costa and San Joaquin Counties.	NE
SOCIO-10: Economic Effects in the Places of Use Resulting from Improved Water Availability and Reliability.	
A1, A2, A3: Implementation of Alternatives 1, 2, or 3 would improve water availability and reliability for the south-of-Delta water users identified in the places of use. Therefore, this water supply would create broad economic benefits for regions whose growth is supported by increased deliveries.	B, LTS
NAA: No mitigation is required. **A1, A2, A3:** No mitigation is required.	
SOCIO-11: Economic Effects in the Places of Use Resulting from Improved Water Availability and Reliability.	
NAA: Under the No-Action Alternative, no project water would be provided to the places of use.	NE
NAA: No mitigation is required.	
3.17 TRAFFIC AND TRANSPORTATION	
TRA-1: Increased Traffic Volumes and Roadway Level of Service During Construction Activities.	
NAA: Under the No-Action Alternative, construction activities would not occur.	NE
A1, A2, A3: Project-related construction activities would result in only a minor increase in roadway traffic and would have no effect on LOS.	LTS
NAA: No mitigation is required. **A1, A2, A3:** Although no mitigation is required, implementing Mitigation Measure TRA-MM-1 would further reduce the level of this less-than-significant **effect**. **Mitigation Measure TRA-MM-1: Develop and Implement a Traffic Control Plan.** In keeping with standard practice, prior to beginning construction of any portion of the project, the project applicant's contractor will develop and implement a Traffic Control Plan (TCP). The TCP will be implemented throughout the course of project construction and will:	

NAA (No-Action Alternative) A1 (Alternative 1) A2 (Alternative 2) A3 (Alternative 3) B (Beneficial)
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Table ES-1
Summary of Effects and Mitigation Measures

Effect	Significance
Mitigation	
a. contain a plan for communicating construction plans with transit providers, emergency service providers, residences, and businesses located in the project vicinity; b. identify roadway segments or intersections that are at or approaching an LOS that exceeds local standards and provide a means for construction-generated traffic to avoid these locations at the peak periods either by traveling different routes or by traveling at nonpeak times of day; c. contain an access and circulation plan for use by emergency vehicles when lane closures and/or detours are in effect; if lane closures occur, provide advance notice to local fire and police departments to ensure that alternative evacuation and emergency routes are designed to maintain response times; d. maintain access to existing residences in the area at all times; e. provide adequate parking for construction trucks and equipment within the designated staging areas throughout the construction period; f. provide adequate parking for construction workers within the designated staging areas; g. require traffic controls on roadways adjacent to the project, including flag persons wearing bright orange or red vests and using a “Stop/Slow” paddle to control oncoming traffic; construction warning signs should be posted in accordance with local standards or those set forth in the Manual on Uniform Traffic Control Devices (Federal Highway Administration 2003) in advance of the construction area and at any intersection that provides access to the construction area; h. require that written notification be provided to contractors regarding appropriate routes to and from the construction site and the weight and speed limits on local roads used to access the construction site; and i. specify that a sign be posted at all active construction areas giving the name and telephone number or email address of the County staff person designated to receive complaints regarding construction traffic. In addition, the following notes will be placed on all grading and building permits: “No construction equipment will be transported or materials delivered between the hours of 6 a.m. and 9 a.m. or 4 p.m. and 6 p.m. Monday through Friday (traffic peak hours).” “No local roads traversing a nearby neighborhood may be used as access to the project site by construction equipment or delivery equipment.” ***Significance after Mitigation: less than significant***	
TRA-2: Increased Traffic Volumes and Roadway Level of Service During Operational Activities.	
NAA: Operational traffic under the No-Action Alternative would contribute to a decrease in LOS on two roadway segments; however, this decrease in LOS would occur with or without project operations. Roadway improvements to correct the LOS are already planned under future no-project conditions, and these improvements would also address the traffic contribution under the No-Action Alternative.	LTS
A1, A2, A3: Project-related operational traffic would decrease the traffic volumes compared to the No-Action Alternative and would decrease the delay along area roadways. However, three roadway segments would operate at an unacceptable LOS with or without project implementation. Since the delay decreases with project implementation, this effect is less than significant.	LTS

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NE (No effect) LTS (Less than significant) PS (Potentially significant) S (Significant) SU (Significant and unavoidable)

Table ES-1
Summary of Effects and Mitigation Measures

Effect	Significance
Mitigation	
NAA: No mitigation is required. **A1, A2, A3:** No mitigation is required.	
TRA-3: Potential for Traffic Safety Conflicts on Delta Roadways During Construction Activities.	
NAA: Under the No-Action Alternative, construction activities would not occur. Thus, there would be no traffic safety conflicts on Delta roadways.	NE
A1, A2, A3: Project-related construction activities would increase the number of large trucks on Delta roadways transporting materials and equipment to the project islands, resulting in potential traffic safety conflicts.	PS
NAA: No mitigation is required. **A1, A2, A3: Mitigation Measure TRA-MM-2: Clearly Mark Intersections in the Project Vicinity that have Poor Visibility.** Before beginning construction at any of the project sites, visibility at intersections in the project vicinity will be assessed visually (as described below). If visibility is poor at any intersection, highly visible signs will be posted at all approaches to the intersection stating that construction activity is taking place and that drivers should be aware of construction vehicles traveling on roads in the area. The project applicant's construction contractor and a representative of the San Joaquin County Department of Public Works will visually assess visibility at intersections along Bacon Island Road, SR 4 from I-5 to Bacon Island Road, SR 4 from Bacon Island Road to the San Joaquin County line, and SR 12 from I-5 to the west end of Bouldin Island. The project applicant's construction contractor and a representative of the Contra Costa County Department of Public Works will visually assess visibility at intersections along SR 4 from the Contra Costa County line to SR 160, Jersey Island Road from Cypress Road to the Jersey-Bradford-Webb ferry, Cypress Road from SR 4 to Jersey Island Road, Delta Road from SR 4 to Holland Tract Road, Holland Tract Road from Delta Road to its end, Byron Highway from SR 4 to Delta Road, and SR 12 from the west end of Bouldin Island to SR 160. ***Significance after Mitigation: less than significant***	
TRA-4: Potential for Traffic Safety Conflicts on Delta Roadways During Operational Activities.	
NAA: The No-Action Alternative would contribute to traffic congestion and traffic safety conflicts on Delta roadways.	S
A1, A2, A3: Project implementation would result in a reduction in agricultural vehicle traffic on Delta roadways during project operation, and project operational activities would not generate additional large-truck traffic.	B, LTS
NAA: No mitigation is required. **A1, A2, A3:** No mitigation is required.	

NAA (No-Action Alternative) A1 (Alternative 1) A2 (Alternative 2) A3 (Alternative 3) B (Beneficial)
NE (No effect) LTS (Less than significant) PS (Potentially significant) S (Significant) SU (Significant and unavoidable)

Table ES-1
Summary of Effects and Mitigation Measures

Effect	Significance
Mitigation	
TRA-5: Change in Circulation on or Access to Delta Roadways During Construction Activities.	
NAA: Under the No-Action Alternative, construction activities would not occur. Thus, there would be no change in circulation or access to Delta roadways.	NE
A1, A2, A3: Because most project-related construction activities would take place on the interior side of levees, substantial changes in circulation or access to Delta roadways would not occur.	LTS
NAA: No mitigation is required. **A1, A2, A3:** No mitigation is required.	
TRA-6: Change in Circulation on or Access to Delta Roadways During Operational Activities.	
NAA: Intensified agricultural activities under the No-Action Alternative would not change the roadway circulation patterns or change the access to Delta roadways.	NE
A1, A2, A3: Project operation would not entail any alterations to the existing roadway network, and the additional project-generated operational traffic would not change roadway circulation patterns.	LTS
NAA: No mitigation is required. **A1, A2, A3:** No mitigation is required.	
TRA-7: Change to the Structural Integrity of County Roads.	
NAA: The No-Action Alternative would not result in substantial deterioration of the structural integrity of county roads.	LTS
A1, A2, A3: Project implementation would result in substantial additional deterioration of the structural integrity of county roads, and project-related levee improvements would also improve the conditions of several project area roadways.	LTS
NAA: No mitigation is required. **A1, A2, A3:** No mitigation is required.	

NAA (No-Action Alternative) A1 (Alternative 1) A2 (Alternative 2) A3 (Alternative 3) B (Beneficial)
NE (No effect) LTS (Less than significant) PS (Potentially significant) S (Significant) SU (Significant and unavoidable)

Table ES-1
Summary of Effects and Mitigation Measures

Effect		Significance
Mitigation		
TRA-8: Fog Hazard for Roadway Traffic on SR 12.		
NAA:	Proposed water storage facilities would not be implemented under the No-Action Alternative; thus, there would be no potential for an increase in the fog hazard for roadway traffic along SR 12.	NE
A1, A2,:	Water storage on the project islands could substantially increase the fog hazard for roadway traffic along SR 12.	LTS
A3:	Water storage on the project islands could substantially increase the fog hazard for roadway traffic along SR 12.	PS
NAA: No mitigation is required. **A1, A2:** No mitigation is required. **A3:** No feasible mitigation is available. ***Significance after Mitigation: potentially significant and unavoidable***		
TRA-9: Change in Ferry Traffic from Jersey Island to Webb Tract.		
NAA:	Under the No-Action Alternative, the amount of traffic using the ferry from Jersey Island to Webb Tract would be substantially similar to existing conditions.	LTS
A1, A2, A3:	Project implementation would decrease the amount of traffic using the ferry from Jersey Island to Webb Tract.	LTS
NAA: No mitigation is required. **A1, A2, A3:** No mitigation is required.		
TRA-10: Increase in Boat Traffic and Congestion on Delta Waterways During Project Operation.		
NAA:	No new recreational facilities would be constructed, and the minor project-related increase in boat traffic from the for-fee hunting program would not substantially increase congestion on Delta waterways.	LTS
A1, A2, A3:	No new project-related recreational facilities would be constructed, and therefore no increase in congestion from project-related boating would occur.	NE
NAA: No mitigation is required. **A1, A2, A3:** No mitigation is required.		

NAA (No-Action Alternative) A1 (Alternative 1) A2 (Alternative 2) A3 (Alternative 3) B (Beneficial)
NE (No effect) LTS (Less than significant) PS (Potentially significant) S (Significant) SU (Significant and unavoidable)

Table ES-1
Summary of Effects and Mitigation Measures

Effect		Significance
Mitigation		
TRA-11: Change in Navigation Conditions on Delta Waterways Surrounding the Project Islands During Project Operation.		
NAA:	Under the No-Action Alternative, no water storage or water intake and discharge facilities would be constructed. Thus, there would be no change in navigation conditions on Delta waterways.	NE
A1, A2, A3:	All maintenance boat docks and gangways would be constructed according to recommended standards, water discharged from the project islands into adjacent waterways would not be of sufficient velocity to affect watercraft, and water storage on the project islands would not substantially increase fog conditions in adjacent waterways.	LTS
NAA: No mitigation is required. **A1, A2, A3:** No mitigation is required.		
TRA-12: Creation of Safety Conflicts on Delta Waterways During Project Construction.		
NAA:	Because the project would not be implemented, barges would not be used and there would be no associated creation of safety conflicts on Delta waterways.	NE
A1, A2, A3:	Barges used to transport rock and moored at the project islands would partially obstruct Delta channels and would contribute to navigation and safety issues on Delta waterways during construction.	PS
NAA: No mitigation is required. **A1, A2, A3: Mitigation Measure TRA-MM-3: Clearly Mark the Barge Moored at Project Islands and Notify the U.S. Coast Guard Prior to the Start of Construction Activities.** The project applicant's construction contractor will ensure that the barge moored at the project islands is well marked and lit in accordance with Title 14 of the California Code of Regulations, Section 7000 *et seq*. Additionally, the construction contractor will contact the U.S. Coast Guard 2 weeks before construction begins so that the Coast Guard can issue a notice to mariners alerting them to the presence of the barge and to construction activities occurring in the area. The contractor must inform the Coast Guard of the location and type of activity, whether night operations will be taking place, and whether there will be lights and buoys. ***Significance after Mitigation: less than significant***		
TRA-13: Increase in the Potential for Safety Problems on Waterways Surrounding the Project Islands.		
NAA:	No new recreational facilities would be constructed, and the minor project-related increase in boat traffic from the for-fee hunting program would not substantially increase the potential for safety issues on Delta waterways.	LTS
A1, A2, A3:	The project would not entail the construction of new recreational facilities; thus, there would be no substantial increase in the potential for boating accidents.	LTS

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Table ES-1
Summary of Effects and Mitigation Measures

Effect		Significance
Mitigation		
NAA: No mitigation is required. **A1, A2, A3:** No mitigation is required.		
3.18 UTILITIES AND SERVICE SYSTEMS		
UT-1: Increase in the Risk to Gas Lines on Bacon Island.		
NAA:	Although there would be no project-related levee improvements that would pose a risk to gas lines, continued subsidence on the project islands would result in increased maintenance of the gas lines.	S
A1, A2, A3:	Flooding of the four project islands would affect monitoring and repairs of existing gas lines. However, the project applicant has entered environmental commitments that have been incorporated into the project to address monitoring and repairs of gas lines.	LTS
NAA: No mitigation is required. **A1, A2, A3:** Although it is not required, implementing Mitigation Measure UT-MM-1 would further reduce the level of this less-than-significant effect. **Mitigation Measure UT-MM-1: Monitor Locations Where Gas Pipelines Cross Bacon Island Levees during and after Levee Construction.** During levee strengthening, the project applicant engineers will install equipment to monitor levee settlement and subsidence rates. After levee completion, the project applicant will conduct weekly inspections to check for potential problems at the gas pipeline crossings, including concerns about levee stability, settlement, and subsidence. If the weekly inspection indicates that settlement, erosion, or slumping at the gas pipelines has occurred, the project applicant will notify PG&E and will implement corrective measures to mitigate any decrease in levee stability near the gas lines. ***Significance after Mitigation: less than significant*** ***Cumulatively beneficial***		
UT-2: Increase in PG&E Response Time to Repair a Gas Line Failure on Bacon Island.		
NAA:	The project would not be implemented, and intensified agricultural operations would not cause a delay in PG&E repairs to gas lines.	NE
A1, A2, A3:	Project implementation would delay PG&E repairs to gas lines. However, Line 57C provides gas system redundancy, and the likelihood of pipeline leak or rupture is the same regardless of whether or not the project is implemented.	LTS
NAA: No mitigation is required. **A1, A2, A3:** No mitigation is required.		

NAA (No-Action Alternative) A1 (Alternative 1) A2 (Alternative 2) A3 (Alternative 3) B (Beneficial)
NE (No effect) LTS (Less than significant) PS (Potentially significant) S (Significant) SU (Significant and unavoidable)

Table ES-1
Summary of Effects and Mitigation Measures

Effect	Significance
Mitigation	
UT-3: Potential Interference with Pipeline Inspection Procedures.	
NAA: The project would not be implemented, and intensified agricultural operations would not interfere with pipeline inspection procedures.	NE
A1, A2, A3: Project implementation could interfere with inspection of existing gas facilities. However, the project applicant has entered environmental commitments that have been incorporated into the project to address relocation and inspection of affected facilities.	LTS
NAA: No mitigation is required. **A1, A2, A3:** No mitigation is required.	
UT-4: Increase in Risk to Electrical Distribution Utilities on the Reservoir Islands.	
NAA: The project would not be implemented, and therefore overhead electrical lines on Webb Tract would not be inundated. However, continued subsidence on the project islands would subject electrical lines to increased risk of structural failure and increased maintenance.	S
A1, A2: Project implementation would inundate overhead electrical lines on Bacon Island and Webb Tract.	S
A3: New electrical service may be necessary, which would not easily be accommodated by existing electrical infrastructure.	S
NAA: No mitigation is required. **A1, A2: Mitigation Measure UT-MM-2: Relocate Electrical Distribution Lines to the Perimeter Levee around Webb Tract.** The project, in coordination with PG&E, will permanently relocate the existing electrical distribution lines on Bacon Island and Webb Tract to the improved perimeter levees during project construction. The new or relocated distribution lines will be located along perimeter levees and will be installed overhead, similar to existing installations. Before temporarily or permanently modifying or relocating existing electrical lines, the project will conduct special-status plant surveys (Mitigation Measure BIO-MM-1) in areas that could be affected by the proposed modifications. If threatened or endangered plant species are found, the project will avoid disturbing those plants when making changes to existing electrical lines.	
A3: Mitigation Measure UT-MM-4: Relocate Electrical Distribution Lines to the Perimeter Levees around Webb and Holland Tracts and Bouldin Island. The project applicant, in coordination with PG&E, will permanently relocate the electrical distribution lines on Webb and Holland Tracts and Bouldin Island to the improved perimeter levees during project construction. The new or relocated distribution lines would be located along perimeter levees and would be installed overhead, similar to existing installations. Before temporarily or permanently modifying or relocating existing electrical lines, the project will conduct special-status plant surveys (Mitigation Measure BIO-MM-1) in areas that could be affected by the proposed modifications. If threatened or endangered plant species are found, the project will avoid disturbing those plants when making changes to existing electrical lines. ***Significance after Mitigation: less than significant*** ***Cumulatively beneficial***	

NAA (No-Action Alternative) A1 (Alternative 1) A2 (Alternative 2) A3 (Alternative 3) B (Beneficial)
NE (No effect) LTS (Less than significant) PS (Potentially significant) S (Significant) SU (Significant and unavoidable)

Table ES-1
Summary of Effects and Mitigation Measures

	Effect	Significance
	Mitigation	
UT-5: Possible Need to Increase Capacity of the Existing Electrical Distribution Lines on the Project Islands.		
NAA:	The project would not be implemented, and intensified agricultural operations would not result in a need to increase the capacity of existing distribution lines.	NE
A1, A2, A3:	Increasing the capacity of existing distribution lines would not require new distribution easements or structures on the project islands.	LTS
NAA: No mitigation is required. **A1, A2, A3:** No mitigation is required.		
UT-6: Possible Need to Expand the Existing Electrical Distribution Lines on Webb Tract, Bouldin Island, and Holland Tract to Serve a Proposed Siphon Station and Recreational Facilities.		
NAA:	The proposed siphon station would not be built and no new recreation facilities would be constructed; thus, there would be no need to expand the electrical distribution lines.	NE
A1, A2, A3:	New electrical service may be necessary, which would not easily be accommodated by existing electrical infrastructure.	S
NAA: No mitigation is required. **A1, A2, A3: Mitigation Measure UT-MM-3: Extend Electrical Distribution Lines to Serve New Siphon and Pump Stations.** The project, in coordination with PG&E, will extend existing electrical distribution lines on the Reservoir Islands where needed to serve new siphon and pump stations. Before modifying existing electrical lines, the project will conduct special-status plant surveys (Mitigation Measure BIO-MM-1) in areas that could be affected by the proposed modifications. If threatened or endangered plant species are found, the project will avoid disturbing those plants when making changes to existing electrical lines. ***Significance after Mitigation: less than significant***		
UT-7: Increase in Demand for Water Supply Services.		
NAA:	No new project-related recreational facilities would be built, and thus there would be no project-related increase in the demand for water supply. Intensified agricultural activities would increase the need for irrigation water, but not measurably so at the scale of monthly water supply modeling.	LTS
A1, A2, A3:	Project implementation would not increase the demand for water supply.	NE
NAA: No mitigation is required.		

NAA (No-Action Alternative) A1 (Alternative 1) A2 (Alternative 2) A3 (Alternative 3) B (Beneficial)
NE (No effect) LTS (Less than significant) PS (Potentially significant) S (Significant) SU (Significant and unavoidable)

Table ES-1
Summary of Effects and Mitigation Measures

Effect		Significance
Mitigation		
A1, A2, A3: No mitigation is required.		
UT-8: Increase in Demand for Sewage Disposal Services.		
NAA:	No new recreational facilities would be constructed, and intensified agricultural operations would not increase the demand for sewage disposal facilities.	NE
A1, A2, A3:	Project implementation would not increase the demand for privately owned sewage disposal facilities.	NE
NAA: No mitigation is required. **A1, A2, A3:** No mitigation is required.		
UT-9: Increase in Demand for Solid Waste Removal.		
NAA:	The No-Action Alternative would not increase the demand for solid waste removal.	NE
A1, A2, A3:	Project implementation would result in a minor increase in the demand for solid waste removal during construction activities. However, the project would implement recycling of waste as feasible, and the amount of solid waste removal would be very small and would not exceed the capacity of existing landfills.	LTS
NAA: No mitigation is required. **A1, A2, A3:** No mitigation is required.		
UT-10: Effects to Infrastructure Facilities on Adjacent Islands.		
NAA:	The proposed water storage facilities would not be constructed, and thus there would be no increased risk of levee failure and seepage to adjacent islands caused by water storage.	NE
A1, A2, A3:	Increased risk of levee failure and seepage to adjacent islands caused by water storage on the Reservoir Islands could threaten the reliability of these facilities and increase maintenance and repair costs. However, the project includes improvements to levees around the project islands, which would increase their reliability.	NE
NAA: No mitigation is required. **A1, A2, A3:** No mitigation is required.		

NAA (No-Action Alternative) A1 (Alternative 1) A2 (Alternative 2) A3 (Alternative 3) B (Beneficial)
NE (No effect) LTS (Less than significant) PS (Potentially significant) S (Significant) SU (Significant and unavoidable)

Table ES-1
Summary of Effects and Mitigation Measures

Effect		Significance
Mitigation		
3.19 WATER SUPPLY		
WS-1: Change in Delta Consumptive Use.		
NAA:	Intensified agricultural uses would not result in a substantial change in Delta consumptive water use.	LTS
A1:	Conversion of the project islands from agriculture to water storage and wildlife habitat management would slightly increase the Delta consumptive use of water (from evaporation and/or crop transpiration).	LTS
A2:	Conversion of the project islands from agriculture to water storage and wildlife habitat management would reduce the Delta consumptive use of water (from evaporation and/or crop transpiration).	B, LTS
A3:	Conversion of the project islands from agriculture to water storage and wildlife habitat management would substantially increase the Delta consumptive use of water (from evaporation and/or crop transpiration).	S
NAA: No mitigation is required. **A1, A2:** No mitigation is required. **A3:** No feasible mitigation measures are available. ***Significance after Mitigation: significant and unavoidable*** ***Cumulatively beneficial***		

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NAA (No-Action Alternative) A1 (Alternative 1) A2 (Alternative 2) A3 (Alternative 3) B (Beneficial)

NE (No effect) LTS (Less than significant) PS (Potentially significant) S (Significant) SU (Significant and unavoidable)

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1 INTRODUCTION AND STATEMENT OF PURPOSE AND NEED

1.1 INTRODUCTION AND PROPOSED PROJECT REQUIRING ENVIRONMENTAL ANALYSIS

This document is a supplemental environmental impact statement (SEIS) prepared for the Delta Wetlands project (the "Proposed Action" in compliance with the National Environmental Policy Act [NEPA]). This SEIS has been prepared by the U.S. Army Corps of Engineers (USACE), Sacramento District, as Federal lead agency under NEPA. The SEIS is a document intended to comply with NEPA. See 33 Code of Federal Regulations (CFR) Part 230 (USACE NEPA regulations) and 33 CFR Part 325, Appendix B ("NEPA Implementation Procedures for the [USACE] Regulatory Program").

In its complete form, an SEIS is composed primarily of a draft document known as a draft SEIS (SDEIS), and a final SEIS (SFEIS) which is comprised of the lead agency's written responses to public and public-agency comments on the SDEIS and any edits/revisions to the SDEIS. This SEIS evaluates the potential adverse effects on the human and natural environment resulting from implementation of the proposed Delta Wetlands project, hereinafter referred to as "the project." The SEIS identifies mitigation measures and alternatives that may avoid, minimize, rectify, reduce, or compensate for adverse effects of the project. Following public review of the SDEIS, an SFEIS will be prepared, in which the lead agency will provide responses to significant comments relating to the analysis provided in the SDEIS and not on the merits of the project.

Delta Wetland Properties (the project applicant) has applied for a new Department of the Army permit to fill approximately 2,156 acres of waters of the United States, including wetlands. USACE Sacramento District, as the NEPA lead agency, has determined that an SEIS should be prepared for the Delta Wetlands project because the previously-issued permit to discharge dredged or fill material into waters of the United States has expired. The SEIS has been prepared to comply with CFR Title 40, 33 CFR Part 230 (USACE NEPA regulations), and 33 CFR Part 325, Appendix B (NEPA Implementation Procedures for the USACE Regulatory Program).

The project applicant has entered into a partnership with Semitropic Water Storage District to develop the project for water storage on the Reservoir Islands, to integrate the project into the operation of the Semitropic Groundwater Storage Bank and the Antelope Valley Water Bank, and to provide project water for agricultural uses within Semitropic's service area; for municipal and industrial (M&I) purposes within Golden State Water Company's service area; for M&I purposes within the Metropolitan Water District of Southern California's service area; and for M&I purposes within the service area of Western Municipal Water District of Riverside County.

The project would involve diverting and storing water on the two Reservoir Islands for later discharge for export or to meet outflow or environmental requirements for the San Francisco Bay/Sacramento-San Joaquin Delta (Bay-Delta) estuary. In addition, the project would involve diverting water seasonally to create and enhance wetlands and to manage wildlife habitat on Bouldin Island and all but the southwestern portion of Holland Tract (the Habitat Islands). To operate the project, the project applicant would improve and strengthen levees on all four islands and would install additional siphons and water pumps on the perimeters of the Reservoir Islands.

Activities that would result in the discharge of dredged or fill material into waters of the United States on the Reservoir Islands interiors consist of the construction of new intake and discharge facilities, new boat berthing facilities adjacent to each intake and discharge facility, and interior grading and perimeter levee improvements. Activities that would result in the discharge of fill material in the channels adjacent to the Reservoir Islands consist of the placement of new intake facilities and installation of fish screens, new boat berthing facilities adjacent to each intake and discharge facility, and new pumps and outfalls to discharge water stored in the reservoirs into the Sacramento-San Joaquin Delta (Delta). Compensation for wetland and wildlife effects of the water storage operations on the Reservoir Islands would be provided by implementing a Compensatory Mitigation Plan (CMP) on two Habitat Islands (Bouldin Island and all but the southwestern portion of Holland Tract).

The project is intended to increase the availability of high-quality water in the Delta for export or outflow through the following six basic parts:

- diversion of water in the Delta;
- water storage on two Reservoir Islands (Bacon Island and Webb Tract);
- compensation for wetland and wildlife effects of the water storage operations on the Reservoir Islands by implementing a CMP on two Habitat Islands (Bouldin Island and Holland Tract);
- supplemental water storage in the Semitropic Groundwater Storage Bank and the Antelope Valley Water Bank south of the Delta;
- provision of water supply for designated south-of-Delta users; and
- release of water for water quality enhancement in the Bay-Delta Estuary in the fall as an additional beneficial water use in a designated place of use.

The first three aspects of the project are unchanged from the project as analyzed in USACE's 2001 Final Environmental Impact Statement (2001 FEIS) and conditioned by State Water Resources Control Board (SWRCB) Water Right Decision 1643 (D-1643), water right protest dismissal agreements between the project applicant and various parties to SWRCB's water right hearings, and the Biological Opinions (BOs) of the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS), in association with the California Department of Fish and Wildlife (formerly the California Department of Fish and Game, abbreviated herein as "DFW"). The portions of the project that remain unchanged are reviewed and updated within this SEIS.

The integration of the in-Delta water storage element with the Semitropic Groundwater Storage Bank and the Antelope Valley Water Bank, and the identification of specific places of uses, are new elements of the project. However, the permitted and operational Semitropic Groundwater Storage Bank, its Stored Water Recovery Unit, and Antelope Valley Water Bank have been fully analyzed in the Semitropic Groundwater Banking Project Final Environmental Impact Report (EIR) (State Clearinghouse [SCH]#1993072024), Semitropic Groundwater Banking Project Stored Water Recovery Unit Final Supplemental EIR (SCH#1999031100), and Antelope Valley Water Bank Final EIR (SCH#2005091117). Therefore, because these elements have independent utility and the environmental impacts of these elements have previously been analyzed, they are not analyzed in this SEIS.

1.2 PROJECT LOCATION

Bacon Island and Bouldin Island are located in San Joaquin County and Holland Tract and Webb Tract are located in Contra Costa County. The location of the four project islands within the Delta is shown in Exhibits 1-1a and 1-1b. Places of use of water supply consist of: (1) Semitropic Water Storage District in Kern County; (2) Metropolitan Water District of Southern California (which also includes Western Municipal Water District of Riverside County) in parts of Los Angeles, Orange, San Diego, Riverside, San Bernardino, and Ventura Counties; and (3) Golden State Water Company in portions of Los Angeles, Orange, San Bernardino, San Luis Obispo, Santa Barbara, and Ventura Counties. The places of use by county are shown in Exhibit 1-2, followed by place of use maps for each potential service area that may receive project water (Exhibits 1-4 through 1-18). All exhibits are presented at the end of this chapter.

1.3 BACKGROUND AND HISTORY

Delta Wetland Properties has applied for a Department of Army permit under Section 404 of the Clean Water Act (CWA) and Section 10 of the Rivers and Harbors Act of 1899 (RHA) to develop two Reservoir Islands (Bacon Island and Webb Tract). Applications with the Department of Army under Section 404 of the CWA for the discharge of dredged or fill material into waters of the United States, and under the RHA Section 10 for activities within navigable waters, were first filed with USACE in 1987. USFWS and NMFS issued no-jeopardy BOs for the project in May and June 2000, respectively. USACE issued a Department of the Army Permit under CWA Section 404 (Permit ID SPK - 1901-09804) for the project on June 26, 2002. Permit 1901-09804 required that construction be completed by December 31, 2007. The project applicant is applying for a new permit for the project because the previously issued permit has expired.

This SEIS supplements the analysis prepared by ICF International (formerly Jones & Stokes, then ICF Jones & Stokes) (abbreviated herein as "ICF") for USACE in the 2001 *Delta Wetlands Project Final Environmental Impact Statement* (2001 FEIS) related to fill of waters of the United States and updates the potential environmental effects associated with the diversion and storage of water by the project, the supplying of that water to the places of use, and the supplemental storage of that water in the Semitropic Groundwater Storage Bank and Antelope Valley Water Bank as specified in the petitions to change water right Application Nos. 29062, 29066, 30268, and 30270 filed with SWRCB.

The potential environmental effects of the project have previously been analyzed in the following documents:

- 1995 *Delta Wetlands Project Draft Environmental Impact Report/Environmental Impact Statement* (1995 DEIR/EIS), prepared by ICF for SWRCB as California Environmental Quality Act (CEQA) lead agency and USACE as NEPA lead agency;

- 2000 *Delta Wetlands Project Revised Draft Environmental Impact Report/Environmental Impact Statement* (2000 RDEIR/EIS), prepared by ICF for SWRCB as CEQA lead agency and USACE as NEPA lead agency;

- 2001 *Delta Wetlands Project Final Environmental Impact Report* (SCH# 1988020824) (2001 FEIR), prepared by ICF for SWRCB as the CEQA lead agency;

- 2001 *Delta Wetlands Project Final Environmental Impact Statement* (2001 FEIS), prepared by ICF for USACE as the NEPA lead agency;

- 2010 *Delta Wetlands Place of Use Draft Environmental Impact Report* (2010 DEIR), prepared by ICF for the Semitropic Water District (Semitropic) as the CEQA lead agency;

- 2011 *Delta Wetlands Project Place of Use Final Environmental Impact Report* (2011 FEIR), prepared by Environmental Science Associates (ESA) for Semitropic as the CEQA lead agency; and

- 2011 *Addendum Delta Wetlands Project Place of Use Final Environmental Impact Report* (2011 Addendum), prepared by ESA for Semitropic as the CEQA lead agency.

The Third District Court of Appeal in *Central Delta Water Agency v. State Water Resources Control Board*, 124 Cal. App. 4th 245 (2004) set aside the previously issued water right permits and accompanying 1995, 2000, and 2001 CEQA documents for failure "to specify an actual use of and the amounts of water to be appropriated." However, the 2001 FEIS was not challenged, nor was the underlying environmental analysis contained in the CEQA documents. In response to the court order, the 2010 DEIR, 2011 FEIR, and 2011 Addendum were prepared by Semitropic as the CEQA lead agency to identify places of use for the water supply and to analyze environmental impacts thereof. This SEIS incorporates by reference the 1995 DEIR/EIS, 2000 RDEIR/EIS, 2001 FEIR, 2001 FEIS, 2010 DEIR, 2011 FEIR, and 2011 Addendum listed above. The incorporated documents are included on each compact disc of the digital version in this SEIS and are also available for public review at the project website (http://deltawetlandsproject.com), and at the USACE website (http://www.spk.usace.army.mil/Missions/Regulatory/Permitting/EnvironmentalImpactStatements.aspx). Table 1-1 provides a sequential listing of major milestones in the project history.

1.4 PROJECT PURPOSE AND NEED

The Proposed Action has been formulated to achieve the purpose and need of the project, as summarized below. The project needs and objectives, as identified by the project applicant below, define the underlying need for the project to which USACE is responding, in conformance with the requirements of NEPA (40 CFR 1502.13 and 33 CFR Part 325, Appendix B).

1.4.1 PROJECT PURPOSE

USACE views the project purpose from the purview of its responsibilities. USACE's interest extends to its permit authority with respect to regulation of waters of the United States, including wetlands.

The overall purpose and need of the project is to increase the availability of high-quality water in the Delta for export or outflow, by storing water on two Reservoir Islands (Webb Tract and Bacon Island) and by doing so, to increase the reliability of water supplies for Semitropic and other places of use including Metropolitan Water District of Southern California, Western Municipal Water District of Riverside County, and Golden State Water Company. The storage of surplus project water in the Semitropic Groundwater Storage Bank and Antelope Valley Water Bank for later use by those users would reduce groundwater overdraft and reduce pumping lift for water users within those basins as well as provide additional dry year water supply reliability for project water users. Further, the project would compensate for wetland and wildlife effects of the water storage operations on the Reservoir Islands by implementing an CMP on two dedicated Habitat Islands (Bouldin Island and Holland Tract).

The project purpose would be met by diverting Delta inflow during times of surplus Delta outflow (after all water quality or flow requirements for the Bay-Delta estuary are met). The diverted water would be stored on the Reservoir Islands until released for export to south-of-Delta users, including Semitropic's service area and the other specified places of use, or for environmental benefits in the Bay-Delta estuary. No infrastructure or facilities, other than those already described in the 2001 FEIS, are proposed to support the project. Water would be delivered via existing and previously approved facilities operated and maintained by the State Water Project (SWP), Central Valley Project (CVP), and those within the proposed places of use. As noted above, the project would provide managed wetlands and wildlife habitat areas.

The integration of the in-Delta water storage element with the Semitropic Groundwater Storage Bank and the Antelope Valley Water Bank were added to the project as part of the 2010 DEIR, 2011 FEIR, and 2011 Addendum and are also added to the project as part of this SEIS. The permitted and operational Semitropic Groundwater Storage Bank, its Stored Water Recovery Unit, and the Antelope Valley Water Bank were fully analyzed in the following prior environmental documents:

- *Semitropic Groundwater Banking Project Final Environmental Impact Report* (SCH#1993072024) (Semitropic Water Storage District and Metropolitan Water District of Southern California 1994),
- *Semitropic Groundwater Banking Project Stored Water Recovery Unit Final Supplemental Environmental Impact Report* (SCH#1999031100) (Navigant Consulting, Inc. and Bookman Engineering, Inc. 2000), and
- *Antelope Valley Water Bank Final Environmental Impact Report* (SCH#2005091117) (ICF 2006).

Therefore, Semitropic Groundwater Storage Bank, its Stored Water Recovery Unit, and the Antelope Valley Water Bank were not analyzed 2010 DEIR, 2011 FEIR, and 2011 Addendum nor are they analyzed in this SEIS, for the reasons previously described above.

Table 1-1 **Delta Wetlands Project History**	
Month/Year	Milestone
July/August 2013	First District Court of Appeal dismisses appeal.
July/August 2013	Project applicant reaches settlements with challengers to 2011 FEIR certification.
March 2013	USACE holds public scoping meeting to receive input on the *NOI to Prepare Delta Wetlands Project Supplemental Environmental Impact Statement*
February 2013	USACE prepares and U.S. Environmental Protection Agency publishes a *NOI to Prepare Delta Wetlands Project Supplemental Environmental Impact Statement* in the Federal Register (February 28, 2013; Vol. 78, No. 40), and USACE publishes a Public Notice on the NOI soliciting public comment and input and providing the date, time, and location of a public scoping meeting.
December 2012	Superior Court decision appealed.
October 2012	San Francisco Superior Court rejects legal challenge to 2011 FEIR. 2011 FEIR upheld in all respects.
October 2011	Legal challenge to certification of 2011 FEIR.
September 2011	Semitropic certifies the *Delta Wetlands Place of Use Environmental Impact Report*, adopts a *Statement of Overriding Considerations* and *Findings of Fact*, and approves the Delta Wetlands Project.
September 2011	Semitropic releases *Addendum to the Final Delta Wetlands Place of Use Environmental Impact Report*
August 2011	Semitropic releases *Final Delta Wetlands Place of Use Environmental Impact Report*, San Bernardino Valley Municipal Water District is removed as a place of use for project water.
May 2010	Semitropic releases *Draft Delta Wetlands Place of Use Environmental Impact Report*, solicits public input.
February 2010	Petitions filed with SWRCB to add additional places of use to project water right applications.
July 2009	Semitropic publishes a Supplemental NOP for the *Delta Wetlands Project Place of Use Environmental Impact Report*.
March 2009	Petitions filed with SWRCB to add places of use and places of underground storage to project water right applications.
November 2008	Semitropic publishes an NOP for this *Delta Wetlands Project Place of Use Environmental Impact Report*.
June 2007 through November 2008	Semitropic Water Storage District, Metropolitan Water District of Southern California, San Bernardino Valley Municipal Water District, Western Municipal Water District of Riverside County, and Golden State Water Company service areas, are identified as places of use for the project.
June 2007	Semitropic partners with the Delta Wetlands Project. Semitropic will operate the project in conjunction with the Semitropic Groundwater Storage Bank to maximize project flexibility and yield. Project water will be provided to Semitropic landowners for irrigation purposes and to other places of use. Semitropic assumes the role of CEQA lead agency.
November 2004	Third District Court of Appeal in *Central Delta Water Agency v. State Water Resources Control Board* sets aside the water right permits for failure “to specify an actual use of and the amounts of water to be appropriated.” The Court requires that the “actual, intended” buyers of the water, and not potential users, be identified in amended water rights applications.
June 2002	USACE issues CWA Section 404 and Section 10 RHA permits. These permits are the final step in a 15-year Federal- and state-approval process, and would allow the project to proceed once basic local construction permits are issued.
April 2002	Sacramento County Superior Court reaffirms the project’s water rights, technical feasibility, environmental soundness, and value to the State of California, unilaterally rejecting all submitted challenges.

Table 1-1 Delta Wetlands Project History	
Month/Year	Milestone
April 2002	A coalition of leading, statewide business organizations endorses the project.
September 2001	SWRCB issues CWA Section 401 Water Quality Certification, verifying that the project will comply with Federal and state water quality requirements.
July 2001	USACE issues the 2001 FEIS, in accordance with NEPA.
February 2001	SWRCB grants water right permits, entitling the project to capture and release surplus Delta water flows.
February 2001	SWRCB certifies the 2001 FEIR in accordance with CEQA, confirming that the project will not adversely impact local wildlife or other natural resources, or disrupt the Delta system.
June 2001	California Department of Fish and Game, now California Department of Fish and Wildlife grants biological permits, concluding project will fully comply with the California Endangered Species Act.
January 2001	SWRCB issues the 2001 FEIR.
October 2000	SWRCB continues water rights hearings for the project prior to issuing permits to ensure that local stakeholders and neighbors have an ongoing opportunity to participate in the approval process.
October 2000	The project applicant, California Urban Water Agencies, and Contra Costa Water District reach agreement on project operating procedures to protect water quality.
August 2000	The project is officially incorporated in the CALFED Bay-Delta Program's Record of Decision, identified as the surface water storage project that can be operational before all others.
May 2000	SWRCB and USACE issue the 2000 Revised Draft EIR/EIS and begin a third public environmental review process.
May/June 2000	NMFS and the USFWS issue updated no-jeopardy BOs to reflect new Federal listings, concluding the project will fully comply with the Federal Endangered Species Act.
July/August 1997	SWRCB conducts initial water rights hearing for the project to review all water rights and water supply issues associated with the project.
April/May 1997	National Marine Fisheries Service and U.S. Fish and Wildlife Service issue no-jeopardy biological opinions, concluding the project will fully comply with the Federal Endangered Species Act.
September 1995	Reflecting overall changes to the project, SWRCB and USACE issue new Draft EIR/EIS and solicit additional public input.
December 1990	SWRCB and USACE issue Draft EIR/EIS, a comprehensive study of the proposed project, potential project alternatives, potential impacts to surrounding natural resources and mitigation required.
February 1988	SWRCB and USACE hold public scoping sessions to ensure that plans for the project do not conflict with other local uses and that local stakeholders and neighbors have an opportunity to comment on the project.
July 1987	The project applicant takes the first step in the approval process by filing water right applications with SWRCB and CWA Section 404 applications with USACE. SWRCB and USACE serve as co-lead state and Federal agencies for the environmental review process for the project.

Notes: USACE = U.S. Army Corps of Engineers; NOI = Notice of Intent; Semitropic = Semitropic Water District; SWRCB = State Water Resources Control Board; NOI = Notice of Intent; NOP = Notice of Preparation; CEQA = California Environmental Quality Act; CWA = Clean Water Act; RHA = Rivers and Harbors Act; FEIS = Final Environmental Impact Statement; NEPA = National Environmental Policy Act; FEIR = Final Environmental Impact Report; Delta = Sacramento-San Joaquin River Delta; EIR/EIS = Environmental Impact Report/Environmental Impact Statement

Sources: ICF 2010:1-20 and 1-21; data compiled by AECOM in 2013

1.5 SCOPE AND FOCUS OF THE SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT

1.5.1 INTENDED USES AND TYPE OF ENVIRONMENTAL IMPACT STATEMENT

NEPA provides an interdisciplinary framework for Federal agencies to develop information that will help them to take environmental factors into account in their decisionmaking (42 United States Code [USC] 4321, 40 CFR 1500.1). According to NEPA, an EIS is required whenever a proposed major Federal action (e.g., a proposal for legislation or an activity financed, assisted, conducted, or approved by a Federal agency) would result in significant effects on the quality of the human environment.

The project is dependent upon Federal action because it would require Federal permits for one or more of the following activities: (i) discharges of fill into waters of the United States, and (ii) activities affecting endangered species protected by the Federal Endangered Species Act (ESA) (16 USC 1531 et seq.). An EIS is an informational document used by Federal agencies in making decisions. An EIS is intended to provide full and open disclosure of environmental consequences prior to final agency action; an interdisciplinary approach to project evaluation; objective consideration of all reasonable alternatives; application of measures to avoid or reduce adverse effects; and an avenue for public and agency participation in decisionmaking (40 CFR 1502.1). NEPA defines mitigation as avoiding, minimizing, rectifying, reducing, or compensating for adverse effects of the proposed action (40 CFR 1508.20).

NEPA requires that a lead agency "include (in an EIS) appropriate mitigation measures not already included in the proposed action or alternatives" (40 CFR 1502.14[f]). An EIS shall also include discussions of "means to mitigate adverse environmental impacts (if not fully covered under Section 1502.14[f])." In preparing a Record of Decision under 40 CFR 1505.2, a lead agency is required to "[s]tate whether all practicable means to avoid or minimize environmental harm from the alternative selected have been adopted, and if not, why they were not. A monitoring and enforcement program shall be adopted and summarized where applicable for any mitigation."

1.5.2 TYPE OF ENVIRONMENTAL IMPACT STATEMENT

The Proposed Action contains enough specificity for a site-specific, project-level environmental review under NEPA. USACE intends this document to provide sufficient formal NEPA analysis for project implementation.

USACE anticipates that Department of the Army CWA Section 404 permit decisions can be made for this project without additional NEPA analysis beyond this SEIS for the entirety of the project area, referred to as the "project area" or "project site" for the Proposed Action, as long as there are no substantial deviations from proposed uses, the conditions of these uses, or project components.

1.5.3 SUMMARY OF FOCUS OF SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT

Since the 2001 FEIS, the project applicant has entered into a partnership with Semitropic to develop the project, to integrate the project into the operation of the Semitropic Groundwater Storage Bank and the Antelope Valley Water Bank, and to provide project water for agricultural uses within Semitropic's service area.

The partnership with Semitropic allows the project to take advantage of Semitropic's innovative and highly successful groundwater banking programs, including its Semitropic Groundwater Storage Bank and Stored Water Recovery Unit and the Antelope Valley Water Bank, managed by a joint powers authority that includes Semitropic. The addition of groundwater banking capability south of the Delta to the project provides additional water supply reliability and operational flexibility in the provision of water to the places of use.

In addition, as part of the application for a new Department of the Army permit to fill waters of the United States, a revised wetland delineation was prepared in 2013, which was verified by USACE. This revised wetland mapping resulted in an increase in the amount of waters that were identified as jurisdictional under the Clean Water Act. However, the currently Proposed Action (i.e., Alternative 2) involves a similar physical amount of earth to be moved in the same locations as identified in the previous environmental documents and previous USACE permit.

1.5.4 SUMMARY OF CHANGES TO THE PROJECT

As stated above, the 2010 DEIR, 2011 FEIR, and 2011 Addendum were prepared in compliance with a court order entered in the case of *Central Delta Water Agency v. State Water Resources Control Board*, 124 Cal.App.4th 245 (2004), to update the water supply portion of the project to identify specific places of use of water. Petitions to change the project's water rights applications to add places of use and places of underground storage have been filed with the SWRCB.

The 2001 FEIS was not challenged, but USACE has determined that it should be supplemented to account for the updates to the water supply portion of the project to identify specific places of use of water, update the potential effects to listed species and cultural resources, and to address the new Department of the Army permit to fill approximately 2,156 acres of waters of the United States, including wetlands. Accordingly, the scope of this NEPA analysis focuses on the changes to the project proposed in the petitions for change regarding specific places of use for project water; estimated diversion amounts, beneficial uses, means of transfer, and storage of water in groundwater banks; and the revised wetland fill. This SEIS also updates the regulatory framework and analyses, where warranted; addresses the elimination of previously proposed recreation facilities; and incorporates environmental commitments into the project that have been developed to mitigate adverse impacts. Specifically, this SEIS examines the environmental effects of the following changes to the project:

- provision of water from the project to the following places of use as proposed in petitions to change water right Application Nos. 29062, 29066, 30268, and 30270 filed with SWRCB:
  - Semitropic Water District (Semitropic) for irrigation purposes (see Exhibit 1-3),
  - Golden State Water Company (Golden State) for municipal and industrial purposes (see Exhibits 1-4a through 1-4g),
  - Metropolitan Water District of Southern California (Metropolitan) for municipal and industrial purposes (see Exhibits 1-5a through 1-5f), and
  - Western Municipal Water District of Riverside County (Western) for municipal and industrial purposes (see Exhibit 1-6);
- banking of project water in the Semitropic Groundwater Storage Bank and Antelope Valley Water Bank for later use by Semitropic, and the other places of use to the extent such banking of water was not analyzed previously in the Semitropic Groundwater Storage Bank and Antelope Valley EIRs;
- a revised levee design to improve Reservoir Island structural integrity;
- a revised wetland delineation prepared in 2013; and
- the elimination of all new recreation facilities that were previously proposed for construction on the four project islands.

Changes to the project and additional information on the places of use are discussed in detail in Chapter 2, “Project Description and Alternatives.”

1.6 LEAD AND COOPERATING AGENCIES

1.6.1 AGENCY ROLES AND RESPONSIBILITIES

NATIONAL ENVIRONMENTAL POLICY ACT FEDERAL LEAD AGENCY

USACE, Sacramento District, is the Federal lead agency under NEPA. USACE has the principal responsibility for issuing Department of the Army CWA Section 404 and Section 10 RHA permits and ensuring that the requirements of NEPA have been met.

The project applicant is requesting permits and related approvals to accommodate implementation of the project on lands the applicant controls. Details are provided in Chapter 2, “Proposed Description and Alternatives.” The Proposed Action represents a Federal action because it would require permits and authorizations required by Federal law.

NATIONAL ENVIRONMENTAL POLICY ACT COOPERATING AGENCIES

Under NEPA, a cooperating agency is any Federal agency other than the lead agency that has jurisdiction by law or special expertise with respect to any environmental impact involved in an action requiring an EIS.

Cooperating agencies are encouraged to actively participate in the NEPA process of the lead agency, review the NEPA document of the lead agency, and use the document when making decisions on the project. USACE sent letters seeking cooperating agency interest to the U.S. Environmental Protection Agency (EPA), U.S. Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS), California Department of Fish and Wildlife (DFW), State Water Resources Control Board (SWRCB), Contra Costa County, and San Joaquin County. Of those agencies, San Joaquin County and SWRCB accepted but later declined, and NMFS declined, the cooperating agency invitation. USACE received a letter from EPA requesting to be a cooperating agency on the SEIS.

Several agencies other than USACE and the cooperating agencies have jurisdiction over the implementation of the elements of the project, as identified below. USACE is the NEPA lead agency for this SEIS.

Federal Agencies

- National Marine Fisheries Service
- U.S. Environmental Protection Agency
- U.S. Fish and Wildlife Service

State Agencies

- California Air Resources Board
- California Department of Boating and Waterways
- California Department of Fish and Wildlife
- California Department of Transportation
- Central Valley Flood Protection Board
- Central Valley Regional Water Quality Control Board
- Native American Heritage Commission
- State Historic Preservation Officer
- State Water Resources Control Board

Regional and Local Agencies

- Antelope Valley Water Bank
- Bay Area Air Quality Management District
- Contra Costa County
- Golden State Water Company
- Metropolitan Water District
- San Joaquin County
- San Joaquin Valley Air Quality Management District
- Semitropic Water Storage District
- Western Municipal Water District of Riverside County

REGULATORY REQUIREMENTS, PERMITS, AUTHORIZATIONS, AND APPROVALS

The following list identifies permits and other approval actions from Federal agencies for which this SEIS may be used during these agencies' decisionmaking processes. The following may be under the purview of regulatory agencies other than the Federal lead agency.

- **U.S. Army Corps of Engineers:** Department of the Army permit under Section 404 of the CWA for discharges of dredge or fill material into waters of the United States and a Section 10 permit under the Rivers and Harbors Act for activities within navigable waters. Consultation for impacts on Federally listed species pursuant to Section 7 of the Endangered Species Act. Consultation for impacts on cultural resources pursuant to Section 106 of the National Historic Preservation Act. Ensuring compliance with Section 401 CWA, through receipt of the project applicant's Section 401 Water Quality Certification. Compliance with the provisions of NEPA pursuant to 40 CFR Sections 1500-1508 and 33 CFR 325 Appendix B.

- **U.S. Environmental Protection Agency:** reviewing and determining the adequacy of the EIS, filing, and noticing; concurrence with Section 404 Clean Water Act permit and Clean Air Act Conformity Determination.

- **U.S. Fish and Wildlife Service:** Federal Endangered Species Act consultation and issuance of incidental take authorization for the take of Federally listed endangered and threatened species. Review and comment on the Section 404 CWA permit application. Coordination with the Fish and Wildlife Coordination Act.

- **National Marine Fisheries Service:** Federal Endangered Species Act consultation and issuance of incidental take authorization for the take of Federally listed endangered and threatened species. Review and comment on the Section 404 CWA permit application.

1.7 AGENCY AND PUBLIC COORDINATION AND SCOPING PROCESS

Pursuant to NEPA, the discussion of potential effects on the environment in this SEIS is focused on those impacts that USACE has determined may be potentially significant.

This SEIS analyzes and discloses the environmental effects of the Delta Wetlands project, identifies ways to reduce or avoid potential adverse environmental effects of the project, and identifies and assesses alternatives to the Proposed Action. Under NEPA, after a lead agency has completed a DEIS, it must consult with and obtain comments from public agencies that have legal jurisdiction with respect to the Proposed Action, and must provide the general public with opportunities to comment on the draft document (40 CFR 1503.1). An FEIS is prepared to respond to those comments and to present the text of the EIS with revisions and updates incorporated.

Information presented in this SEIS will be used by USACE in its evaluation of Delta Wetlands' permit applications. The SEIS may be used by other agencies for compliance with NEPA for other approvals needed for project implementation.

USACE will circulate this SEIS for public review before making a decision on the proposal. If USACE determines that the SEIS meets NEPA requirements, it will adopt the document. When it decides on Delta Wetlands' Section 404 and Section 10 permit applications, USACE will prepare a Record of Decision (ROD) regarding its determination, the alternatives analyzed, the mitigation measures required as a condition of permit approval, and monitoring and enforcement of the required mitigation measures.

On Feburary 28, 2013, USACE issued a notice of intent (NOI) (Appendix A) to inform agencies and the general public that an SEIS was being prepared and invited comments on the scope and content of the document. The NOI was published in the *Federal Register*, Vol. 78, No. 40, on February 28, 2013. The NOI also included notification regarding the public scoping meeting, which was held from 4-7 p.m. at the Tsakopoulos Galleria Library located at 828 I Street in Sacramento, CA. The NOI is also posted on USACE's website at http://www.spk.usace.army.mil/Missions/Regulatory/Permitting/EnvironmentalImpactStatements.aspx A court reporter was present to receive comments submitted by any agency representative or member of the public who wished to do so. No comments were submitted during the public scoping meeting. Comments from two public agencies and two members of the public were received during the scoping period, which ran for a 60-day period from February 28, 2013 through April 29, 2013. Appendix A of this SEIS contains copies of the comments that were received on the NOI and considered in this SEIS.

This SEIS includes an evaluation of 19 environmental issue areas and other NEPA-mandated topics per Council on Environmental Quality [CEQ] Section 1502.102[2][C]i-v) (e.g., environmental effects of the Proposed Action, adverse effects which cannot be avoided, relationship between short-term uses and long-term productivity, alternatives as needed, irreversible and irretrievable commitments of resources). The 19 environmental issue areas are as follows:

- Aesthetics
- Agricultural Resources
- Air Quality
- Aquatic Resources
- Biological Resources
- Climate Change
- Cultural Resouces
- Environmental Justice
- Floodplain Management
- Hazardous Waste and Materials
- Hydrology and Water Quality
- Land Use
- Noise
- Parks and Recreation
- Public Services
- Socioeconomics
- Traffic and Transportatiaon
- Utilities and Service Systems
- Water Supply

1.8 ORGANIZATION AND AVAILABILITY OF THIS SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT

The content and format of this SEIS are designed to meet the requirements of NEPA, the NEPA regulations issued by the CEQ, and USACE NEPA regulations, as well as Appendix B to those regulations (NEPA implementation). The SEIS is organized into the following chapters so that the reader can easily obtain information about the project and its specific environmental issues.

- The **cover sheet** identifies lead and any cooperating agencies, contact information for the lead agency contact person, the title of the project and its location, type of document, a brief abstract, and comment submission information, and any agency-specific information.

- The **Executive Summary** presents a brief overview of the Proposed Action and alternatives; a summary of major conclusions; a summary of known areas of controversy and issues to be resolved; a summary of issues raised by agencies and the public; a discussion of opportunities for public participation in the NEPA process; and a table listing the environmental effects, mitigation measures, and the significance after implementation of mitigation (including unavoidable effects).

- Chapter 1, **"Introduction and Statement of Purpose and Need,"** provides project location information and a brief history of the project and the prior environmental documents; explains the NEPA process; specifies the underlying purpose and need to which the lead agency is responding in considering the Proposed Action and alternatives; lists the lead and cooperating agencies that may have discretionary authority over the project; summarizes the public scoping process; outlines the organization of the document; and provides a table of acronyms and abbreviations.

- Chapter 2, **"Project Description and Alternatives,"** presents a summary of the Proposed Action and the alternatives thereto. This chapter also provides a summary of changes to the project or alternatives, new information, and changed circumstances related to the project since the 2001 FEIS was prepared. This chapter provides a description of each alternative in comparison with the Proposed Action, and describes alternatives considered but eliminated from further consideration.

- Chapter 3, **"Affected Environment and Environmental Consequences,"** is divided into 21 sections. Section 3.0 explains the approach to the affected environment, presents the assumptions used in the environmental analysis, and provides definitions of the types of environmental effects. Section 3.0 also introduces the analysis of cumulative impacts. Each of the remaining sections in Chapter 3 is devoted to the environmental analysis of each particular environmental issue area.

- Chapter 4, **"Other Statutory Requirements,"** presents an analysis of potential growth-inducing effects of the project as well as the potential irreversible and irretrievable commitment of resources, relationship between short-term uses of the environment and maintenance and enhancement of long-term productivity, and significant and unavoidable adverse environmental effects of the project.

- Chapter 5, **"References,"** provides a bibliography of sources cited in the SEIS and identifies the names and affiliations of persons who provided information used in preparing the document.

- Chapter 6, **"List of Preparers,"** lists individuals who were involved in preparing this SEIS.

- Chapter 7, **"Index,"** contains the NEPA-required index for easy reference of topics and issues.

- **Technical appendices** contain the background information that supports the SEIS.

This SDEIS is being distributed to interested agencies, stakeholder organizations, and individuals. This distribution ensures that interested parties have an opportunity to express their views regarding the environmental effects of the project, and to ensure that information pertinent to permits and approvals is provided to decision makers for the lead agency and NEPA cooperating agencies. This document is available for review by the public at USACE's website, http://www.spk.usace.army.mil/Missions/Regulatory/Permitting/EnvironmentalImpactStatements.aspx. The SDEIS is being distributed for a 45-day review period that begins on May 29, 2015 and will end on July 13, 2015.

The review period under NEPA will end on July 13, 2015; however, the USACE will continue to accept comments on the SDEIS until the ROD is issued. Comments should be sent to the following address:

Marc Fugler
U.S. Army Corps of Engineers, Sacramento District, Regulatory Branch
1325 J Street, Room 1350
Sacramento, CA 95814-2922
E-mail: Marc.A.Fugler@usace.army.mil

If comments are provided via e-mail, please include the project title in the subject line, attach comments in MS Word format, and include the commenter's U.S. Postal Service mailing address.

A public hearing on the SDEIS will be conducted by USACE on June 10, 2015 from 4 to 7 p.m. at the Tsakopoulos Galleria, 828 I St, Sacramento, California. Comments on the SDEIS may be provided during the public meeting/hearing, and written comments may also be provided at any time during the comment period as described above.

Once all comments have been assembled and reviewed, responses will be prepared to address significant environmental issues that have been raised in the comments. The responses will be included in a SFEIS.

1.9 STANDARD TERMINOLOGY, ACRONYMS, AND ABBREVIATIONS

°F	degrees Fahrenheit
µg/l	micrograms per liter
µS/cm	microSiemens per centimeter
AB	Assembly Bill
ACHP	Advisory Council on Historic Preservation
ACS	American Community Survey
af/day	acre-feet per day
af/yr	acre-feet per year
AG	Attorney General
APE	area of potential effect
ARB	California Air Resources Board
B	beneficial
BA	Biological Assessment
BAAQMD	Bay Area Air Quality Management District
Bcf/day	billion cubic feet per day
BDCP	Bay Delta Conservation Plan
BMPs	best management practices
BO	Biological Opinion

Br-	bromide
CAA	Clean Air Act
CAAQS	California ambient air quality standards
$CaCO_3$	calcium carbonate
CAFE	corporate average fuel economy
CALFED	CALFED Bay-Delta Program
Caltrans	California Department of Transportation
CAP	Climate Action Plan
CAPCOA	California Air Pollution Control Officers Association
CBD	Central Business District
CCAA	California Clean Air Act
CCCMVCD	Contra Costa County Mosquito and Vector Control District
CCF	Clifton Court Forebay
CCTA	Contra Costa Transportation Agency
CCWD	Contra Costa Water District
CDC	California Department of Conservation
CDEC	California Data Exchange Center
CDP	Census Designated Place
CEC	California Energy Commission
CEQ	Council on Environmental Quality
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
CFR	Code of Federal Regulations
cfs	cubic feet per second
CH_4	methane
CIMIS	California Irrigation Management Information System
CIWMA	California Integrated Waste Management Act
Cl_2	chlorine
CMP	Compensatory Mitigation Plan
CNEL	community noise equivalent level
CO	carbon monoxide
CO_2	carbon dioxide
CPUC	California Public Utilities Commission
CRHR	California Register of Historic Resources
CT	Census Tract
CUWA	California Urban Water Agencies
CVOC	Central Valley Operations Center
CVP	Central Valley Project
CVP Jones	CVP Jones Pumping Plant
CVPIA	Central Valley Project Improvement Act
CWA	Clean Water Act
dB	decibel

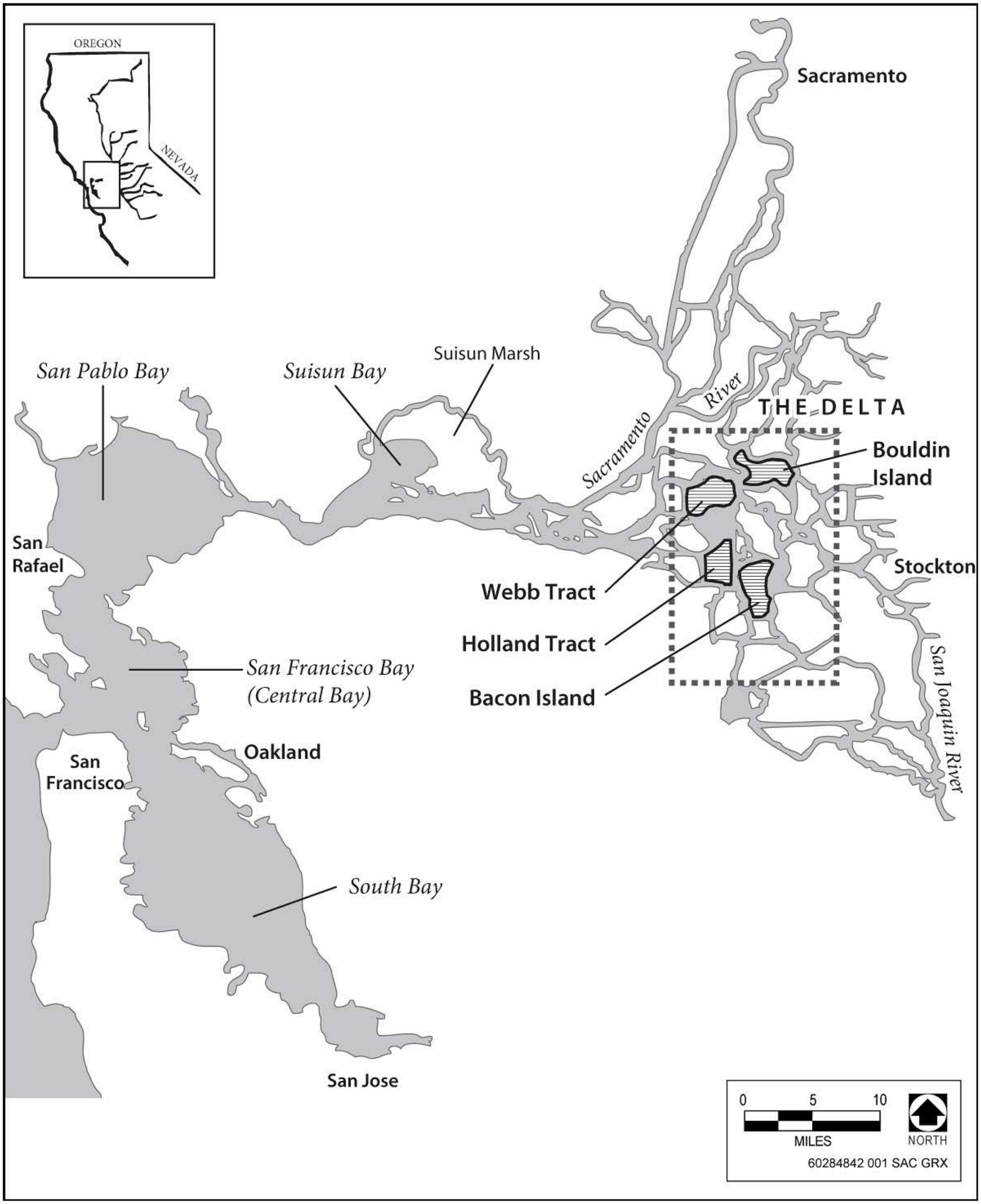
dBA	A-weighted decibel
DBP	disinfection by-product regulations
DCC	Delta cross channel
Delta	Sacramento-San Joaquin Delta
DFW	California Department of Fish and Wildlife
DICU	Delta Island Consumptive Use
DMC	Delta-Mendota Canal
DMC-CA	Delta-Mendota Canal – California Aqueduct
DO	dissolved oxygen
DOC	dissolved organic carbon
DOF	Department of Finance
DPC	Delta Protection Commission
DRMS	Delta Risk Management Strategy
DSOD	Division of Safety of Dams
DWR	California Department of Water Resources
E/I	export/import
EBMUD	East Bay Municipal Utility District
EC	electrical conductivity
EDD	Employment Development Department
EIR	environmental impact report
EIS	environmental impact statement
EISA	Energy and Independence Security Act of 2007
EO	Executive Order
EPA	Environmental Protection Agency
EPCA	Energy Policy and Conservation Act
ERP	Ecosystem Restoration Program
ESA	Federal Endangered Species Act
ET	evapotranspiration
ETL	Engineering Technical Letter
EWA	Environmental Water Account
FMMP	Farmland Mapping and Monitoring Program
FMWT	Fall Mid-Water Trawl
FOC	final operations criteria
fps	feet per second
FRWP	Freeport Regional Water Project
FSEIS	Final Supplemental Environmental Impact Statement
FWUA	Friant Water Users Authority
g/yr	grams per year
gal/day	gallons per day
GHGs	greenhouse gases
Golden State	Golden State Water Company
GWP	global warming potential

HCM	Highway Capacity Manual
HDD	horizontal directional drilling
HFCs	hydrofluorocarbons
HMAC	Habitat Management Advisory Council
HPMP	Historic Properties Management Plan
HPTP	Historic Properties Treatment Plan
HSWA	Hazardous and Solid Waste Amendments of 1984
I-5	Interstate 5
IDSM	In-Delta Storage Model
IEP	Interagency Ecological Program
IFM	Integrated Farm Management
IpM	integrated pest management
ISD	Ironhouse Sanitary District
ISI	CALFED Bay-Delta Program Integrated Storage Investigations Program
kV	kilovolt
L_{dn}	day-night sound level
Ldn/CNEL	noise level/community noise equivalent level
L_{eq}	equivalent sound level
L_{max}	maximum sound levels
L_{min}	minimum sound levels
LOS	level of service
LTS	less than significant
LTS-M	less than significant with mitigation
LURMP	Land Use and Resource Management Plan for the Primary Zone of the Delta
L_{xx}	percentile-exceeded sound levels
L_{XX}	Exceedance Sound Level
M&I	municipal and industrial
MBK	MBK Engineers
MCL	maximum contaminant level
Metropolitan	Metropolitan Water District of Southern California
mg/l	milligram per liter
MMRP	mitigation monitoring and reporting program
MOA	Memorandum of Agreement
mpg	miles per gallon
mph	miles per hour
msl	mean sea level
MT	metric tons
MTAC	Monitoring Technical Advisory Committee
MWQI	Municipal Water Quality Investigations
MY	model year
N_2O	nitrous oxide
NAAQS	National Ambient Air Quality Standards

NAHC	Native American Hertitage Commission
NBHA	North Bouldin Habitat Area
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NHTSA	National Highway Traffic Safety Administration
NMFS	National Marine Fisheries Service
NO_2	nitrogen dioxide
NOI	notice of intent
NO_X	nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
NRDC	Natural Resources Defense Council
NRHP	National Register of Historic Places
OCAP	Operational Criteria and Plan
OMR	Old and Middle River
OPR	Office of Planning and Research
OSHA	Occupational Safety and Health Administration
PA	Programmatic Agreement
PAR	PAR Environmental Services
PBS	Public Broadcasting System
PDA	Protest Dismissal Agreement
PFCs	perfluorocarbons
PG&E	Pacific Gas & Electric Company
PL	Public Law
PM_{10}	particulate matter with a diameter of 10 microns or less
$PM_{2.5}$	particulate matter with a diameter of 2.5 microns or less
POC	particulate organic carbon
POU	places of use
ppb	parts per billion
ppd	pounds per day
PPIC	Public Policy Institute of California
PPMP	pollution prevention and monitoring program
psi	per square inch
RBDD	Red Bluff Diversion Dam
RCRA	Resource Conservation and Recovery Act
RDs	Reclamation Districts
RDEIR/EIS	Revised Draft Environmental Impact Report/Environmental Impact Statement
Reclamation	U.S. Bureau of Reclamation
RHA	Rivers and Harbors Act of 1899
RMA	Resource Management Associates
ROD	record of decision
ROG	reactive organic gases
RWQCB	Regional Water Quality Control Board

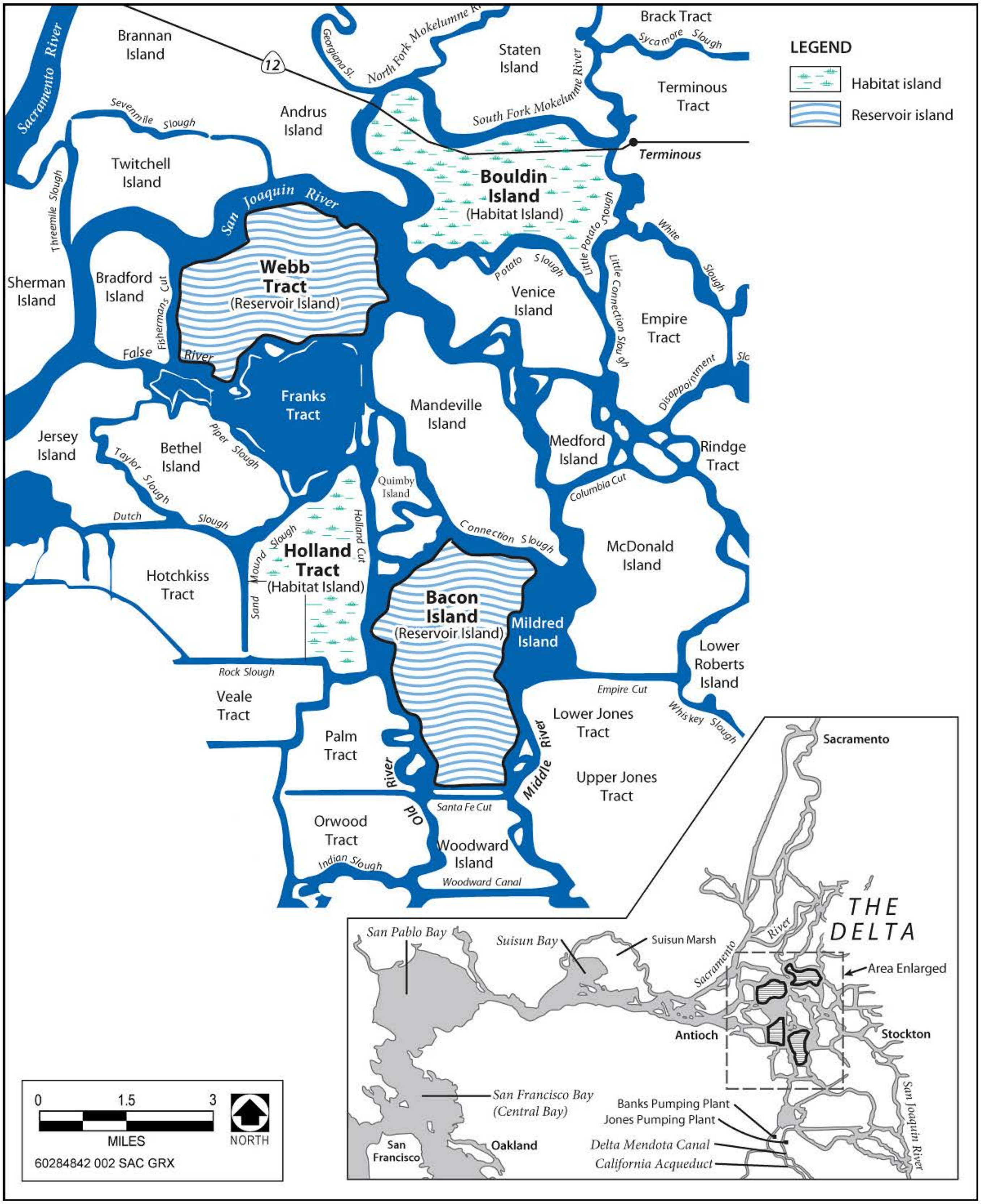
SA	Settlement Agreement
SB	Senate Bill
SBA	South Bay Aqueduct
SCVWD	Santa Clara Valley Water District
SCWA	Sacramento County Water Agency
SDEIS	Supplemental Draft Environmental Impact Statement
SDWA	Safe Drinking Water Act
SEIS	supplemental environmental impact statement
Semitropic	Semitropic Water Storage District
Settlement	Stipulation of Settlement
SF_6	sulfur hexafluoride
SFBAAB	San Francisco Bay Area Air Basin
SFEIS	Supplemental Final Environmental Impact Statement
SHPO	State Historic Preservation Officer
SIP	state implementation plan
SJCMVCD	San Joaquin County Mosquito and Vector Control District
SJCOG	San Joaquin Council of Governments
SJVAB	San Joaquin Valley Air Basin
SJVAPCD	San Joaquin Valley Air Pollution Control District
SO_2	sulfur dioxide
SR	State Route
SU	significant and unavoidable
SVWMSA	Sacramento Valley Water Management Settlement Agreement
SWP	State Water Project
SWP Banks	SWP Harvey O. Banks Pumping Plant
SWP/CVP	State Water Project/Central Valley Project
SWPPP	stormwater pollution prevention plan
SWRCB	State Water Resources Control Board
taf	thousand acre-feet
taf/yr	thousand acre-feet per year
TCCA	Tehama-Colusa Canal Authority
TCP	Traffic Control Plan
TDF	through-Delta facility
TDS	total dissolved solids
THM	trihalomethane
TMDL	total maximum daily limit
TOC	total organic carbon
tpy	tons per year
TRB	Transportation Research Board
U.S.	United States
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service

VAMP	Vernalis Adaptive Management Plan
VERA	voluntary emission reduction agreement
WDRs	waste discharge requirements
Western	Western Municipal Water District
WQCP	Water Quality Control Plan
WQMP	Water Quality Management Plan
WY	water year



Source: ICF 2010, Adapted by AECOM in 2013

Exhibit 1-1 **Delta Wetlands Project Islands Regional Location**

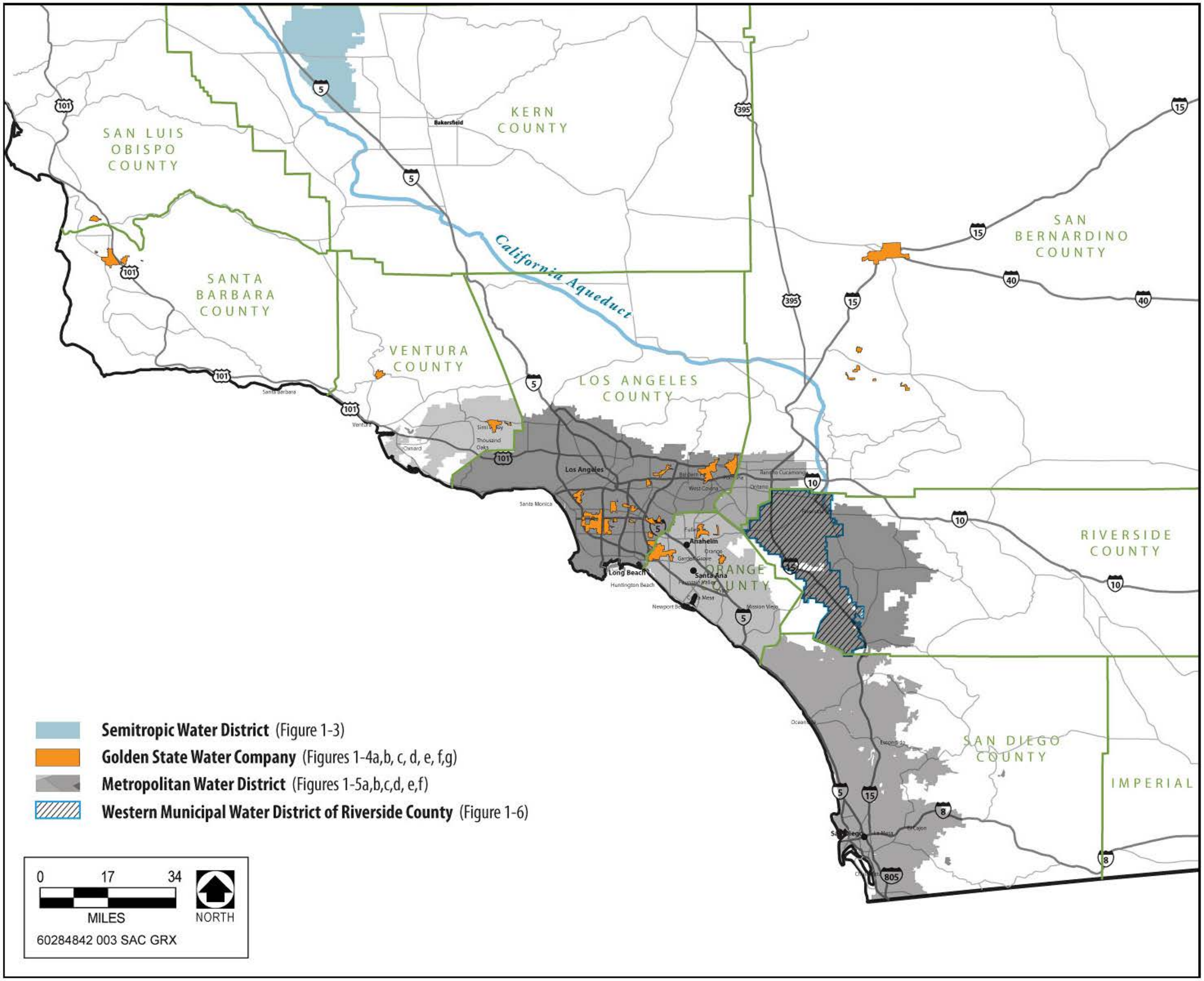


Source: ICF 2010, Adapted by AECOM in 2013

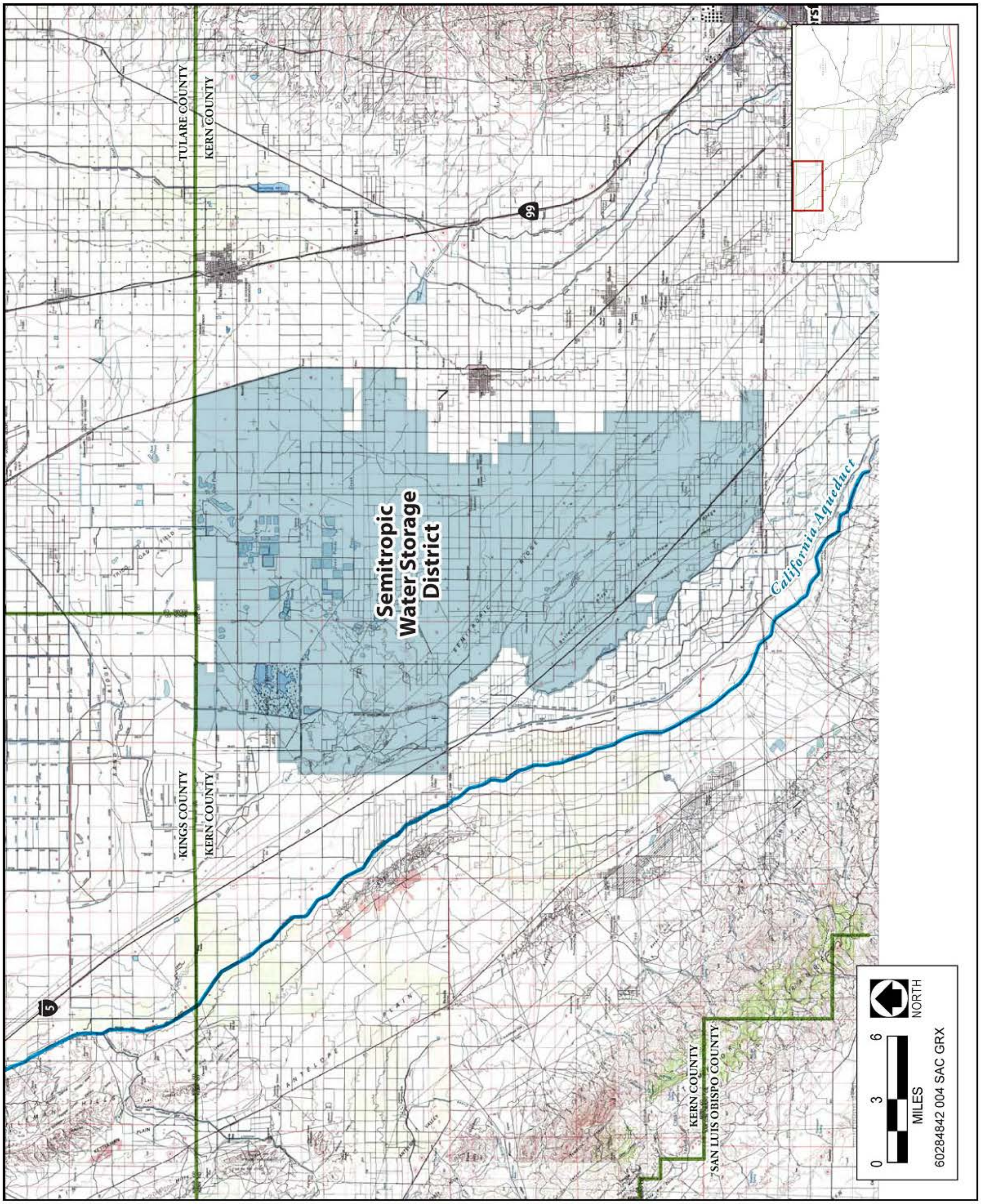
Exhibit 1-2 **Delta Wetlands Project Islands**

Exhibit 1-3

Source: ICF 2010, Adapted by AECOM in 2013



Delta Wetlands Project Places of Use (Overview by County)

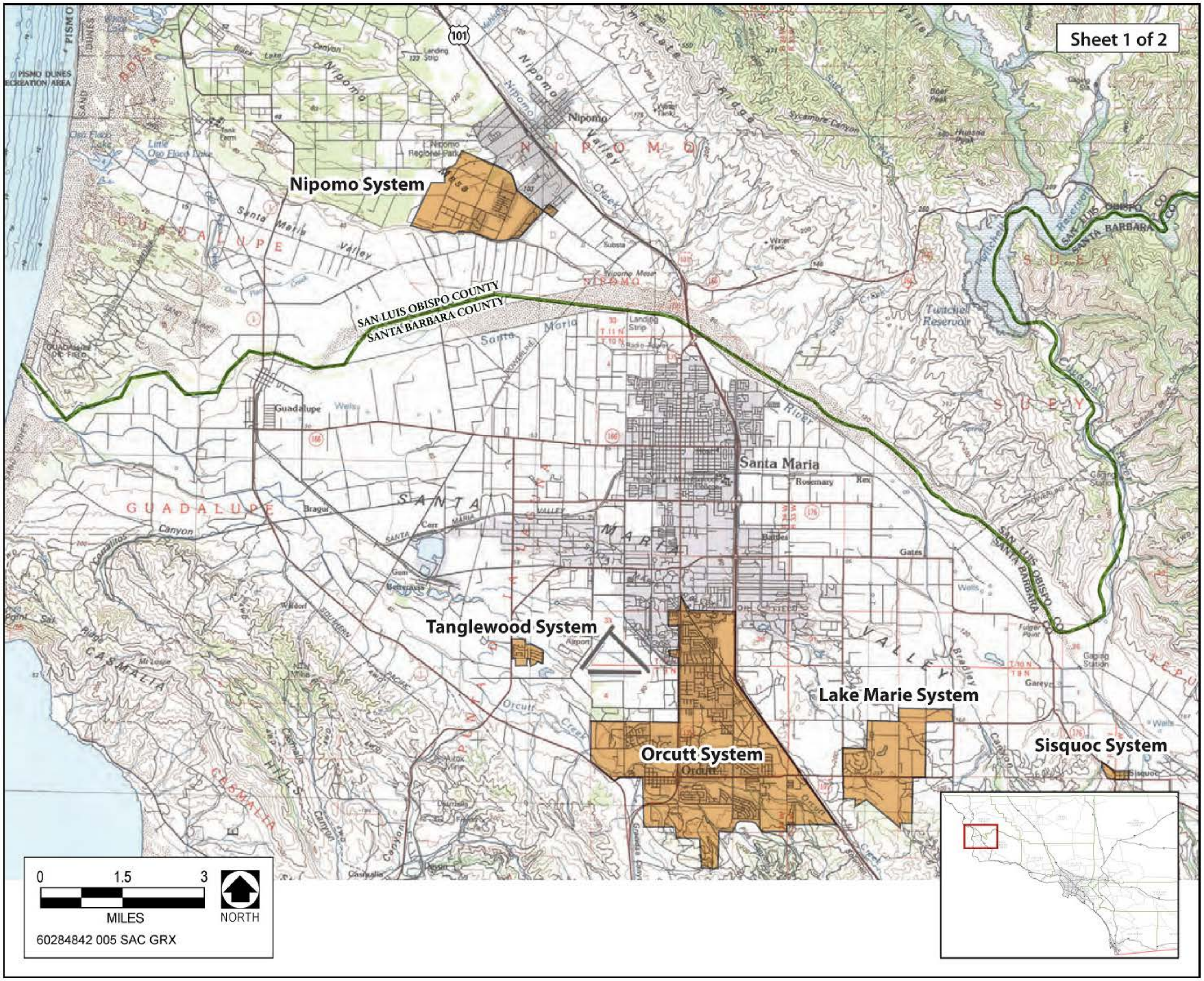


Source: ICF 2010, Adapted by AECOM in 2013

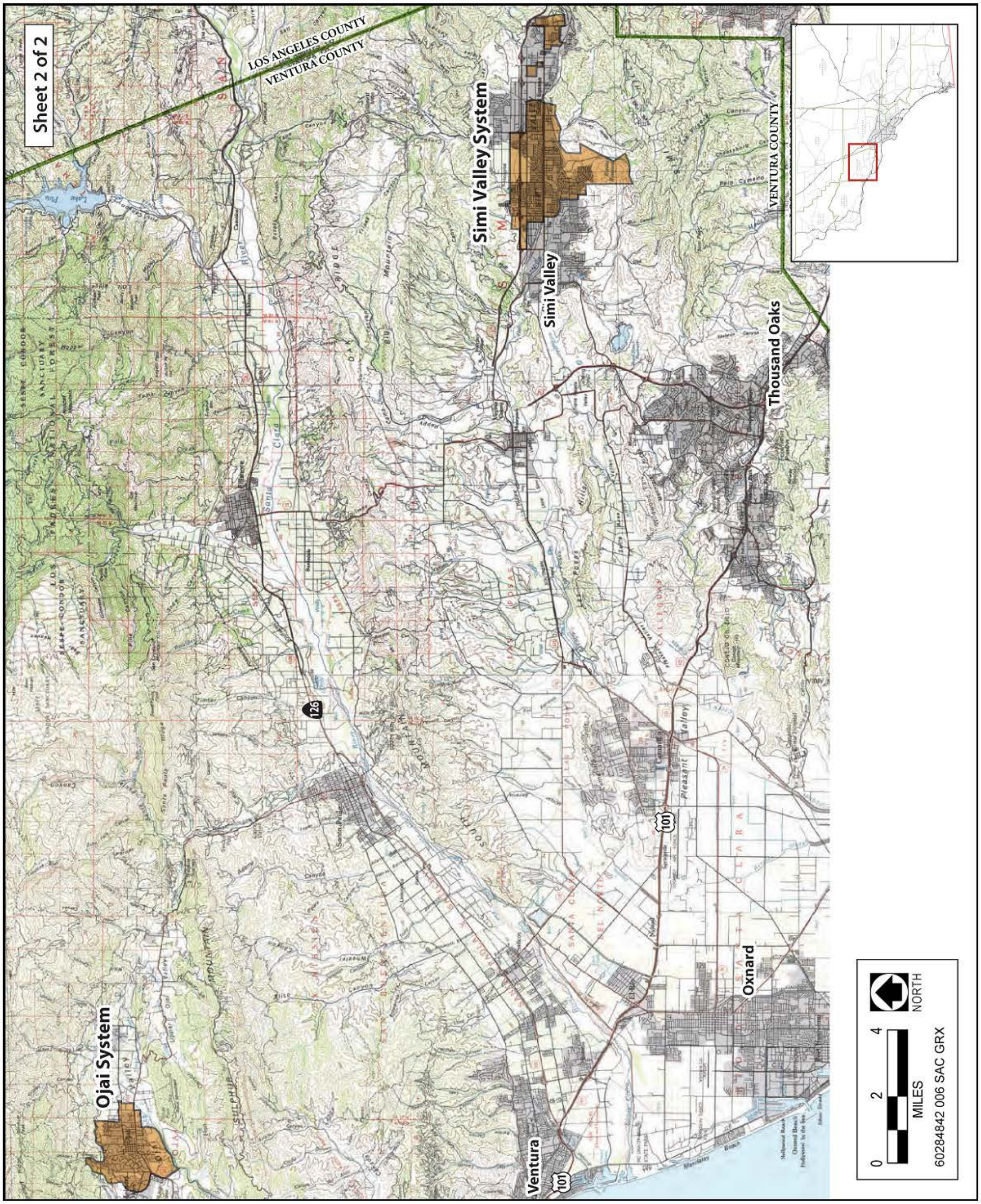
Exhibit 1-4 **Semitropic Water Storage District Place of Use**

Exhibit 1-5

Golden State Water Company Region 1 Place of Use



Source: ICF 2010, Adapted by AECOM in 2013



Source: ICF 2010, Adapted by AECOM in 2013

Exhibit 1-6 **Golden State Water Company Region 1 Place of Use**

Exhibit 1-7 **Golden State Water Company Region 2 Place of Use**

Source: ICF 2010, Adapted by AECOM in 2013

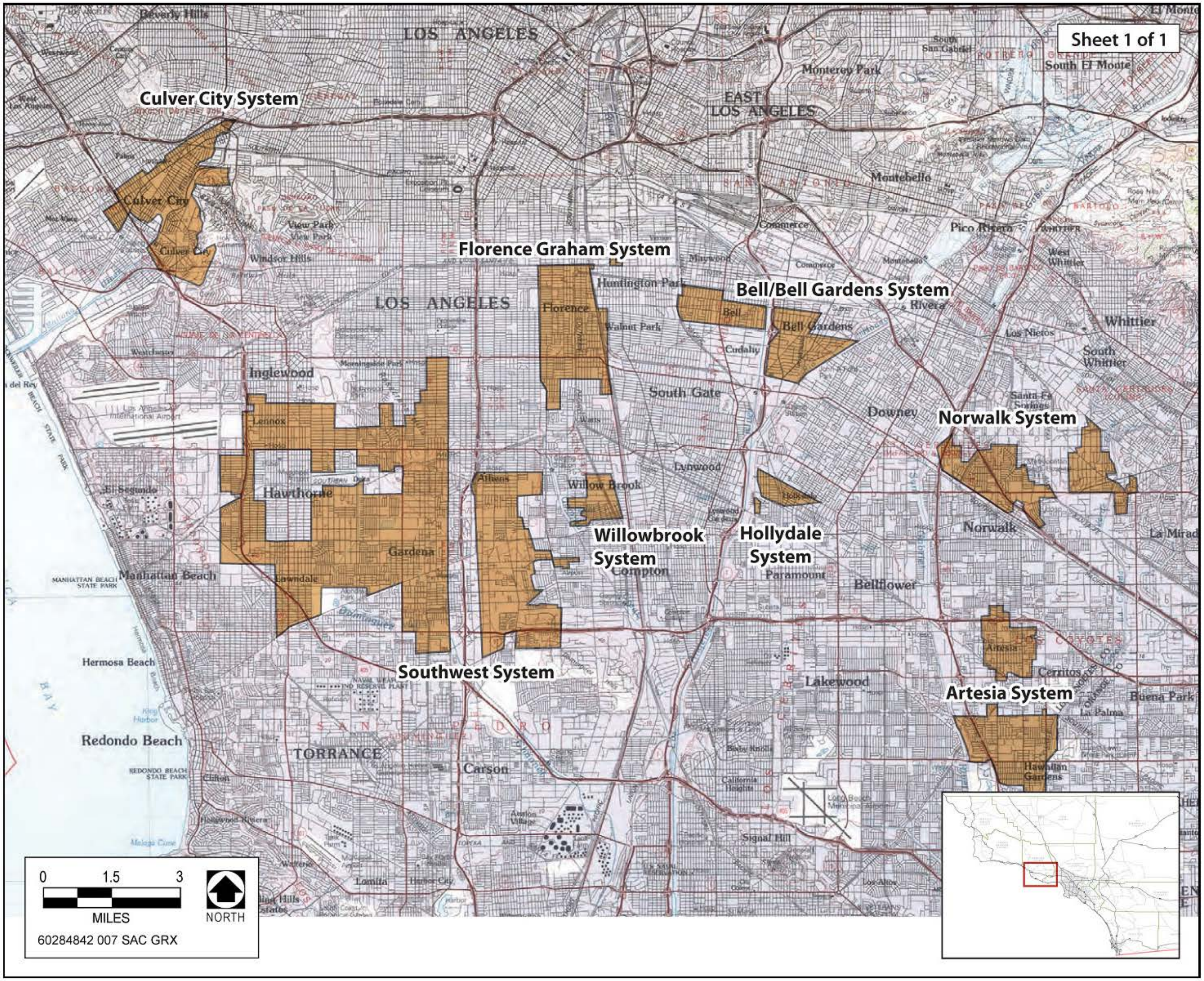
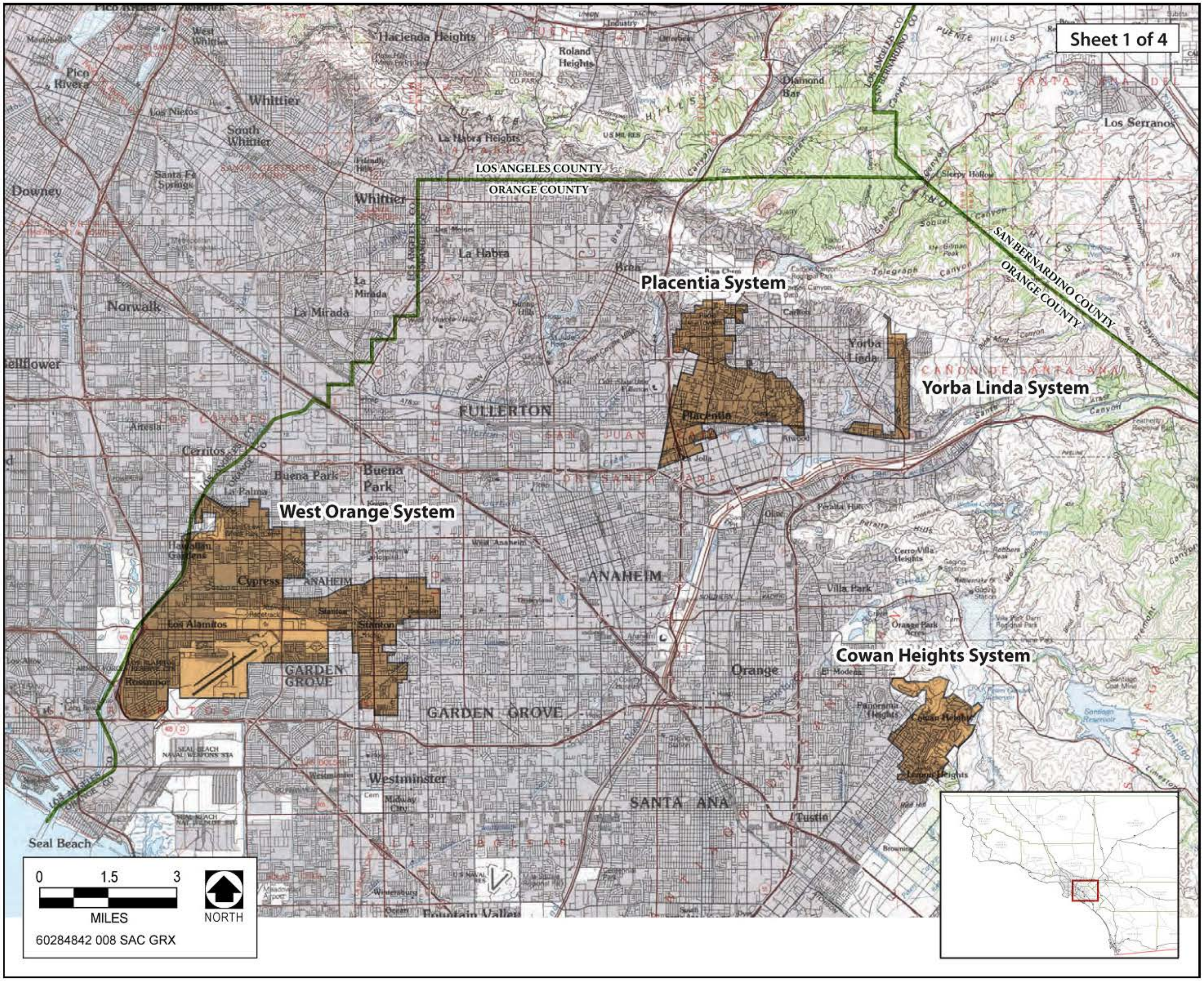
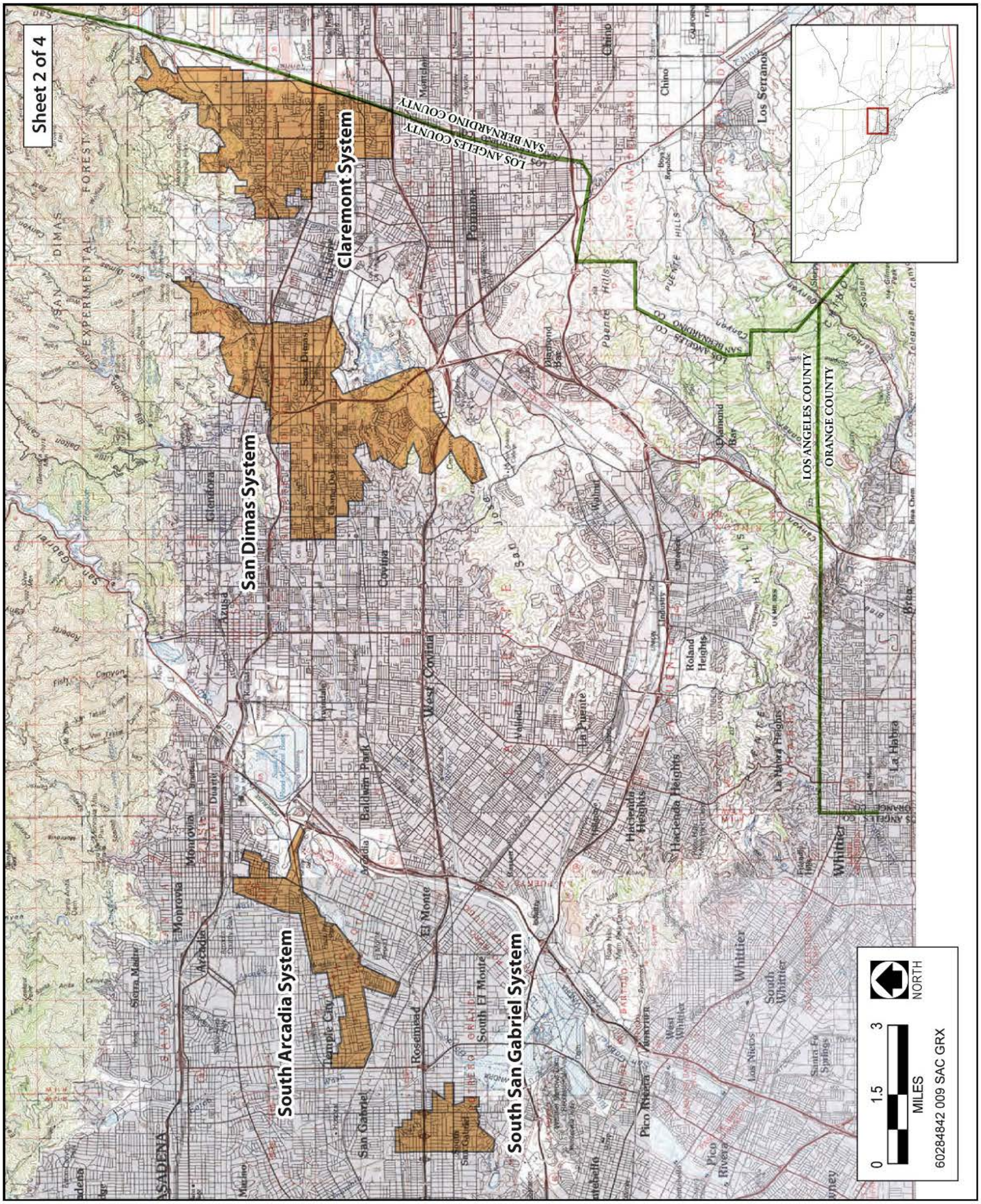


Exhibit 1-8

Golden State Water Company Region 3 Place of Use

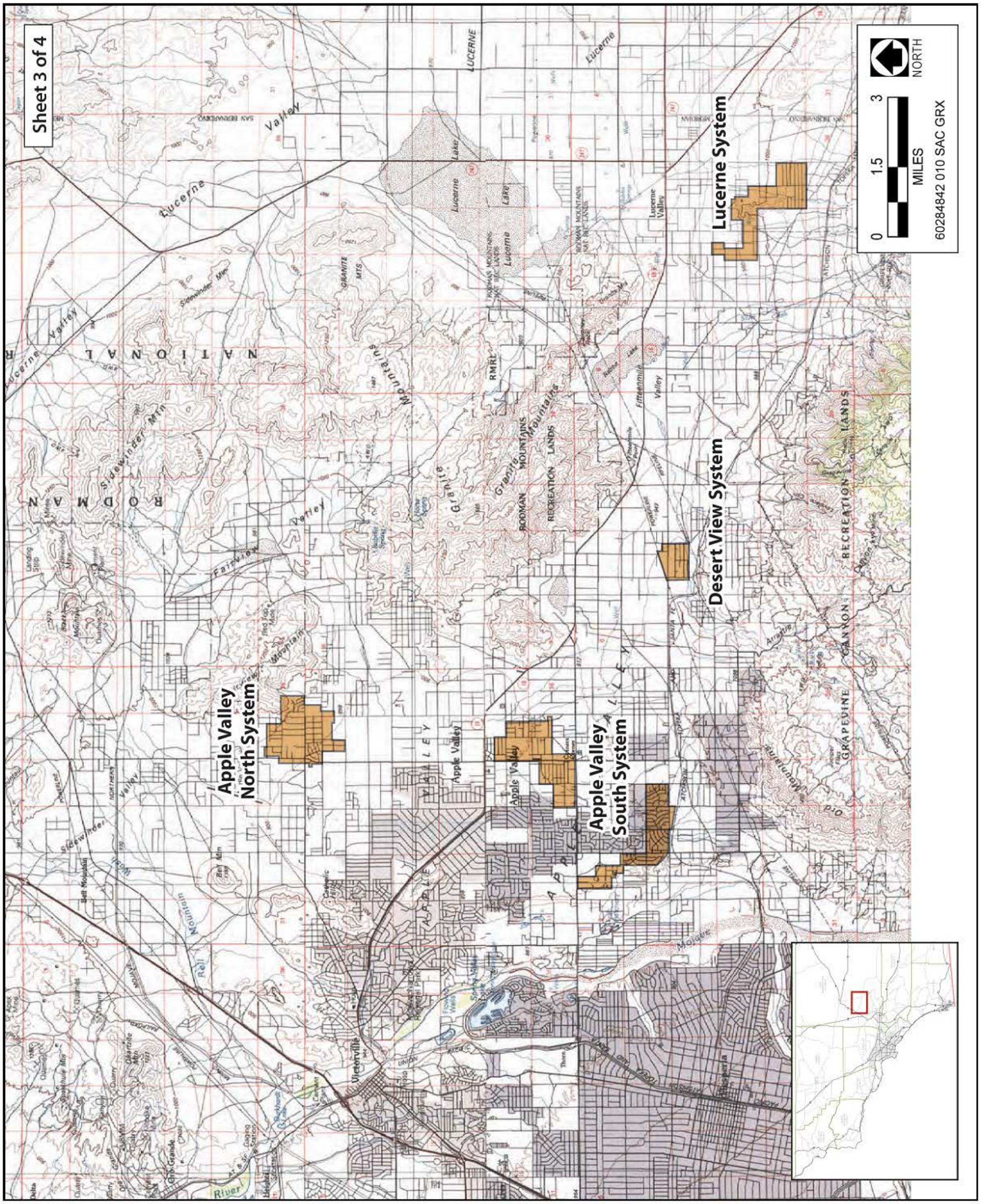
Source: ICF 2010, Adapted by AECOM in 2013





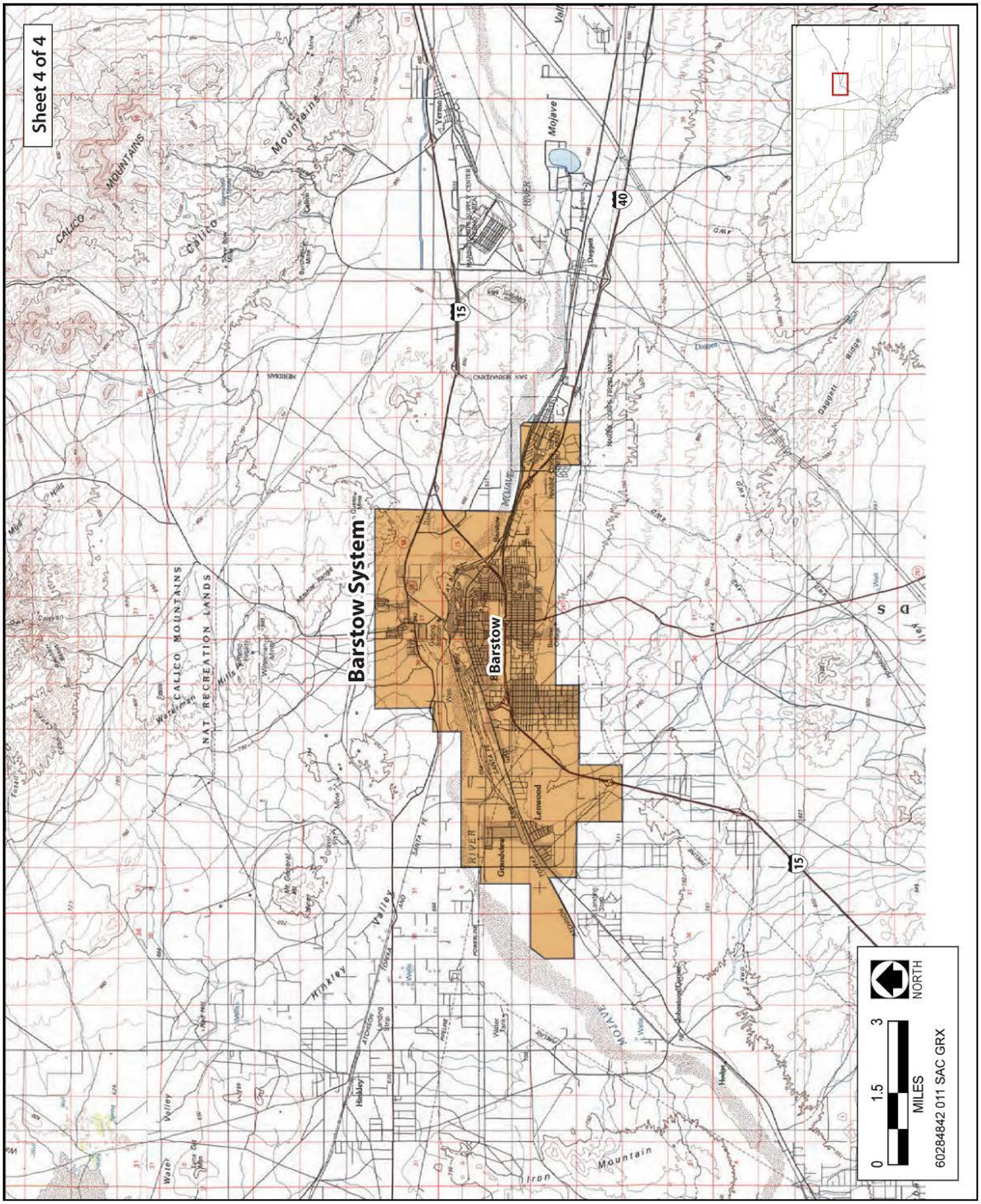
Source: ICF 2010, Adapted by AECOM in 2013

Exhibit 1-9 **Golden State Water Company Region 3 Place of Use**



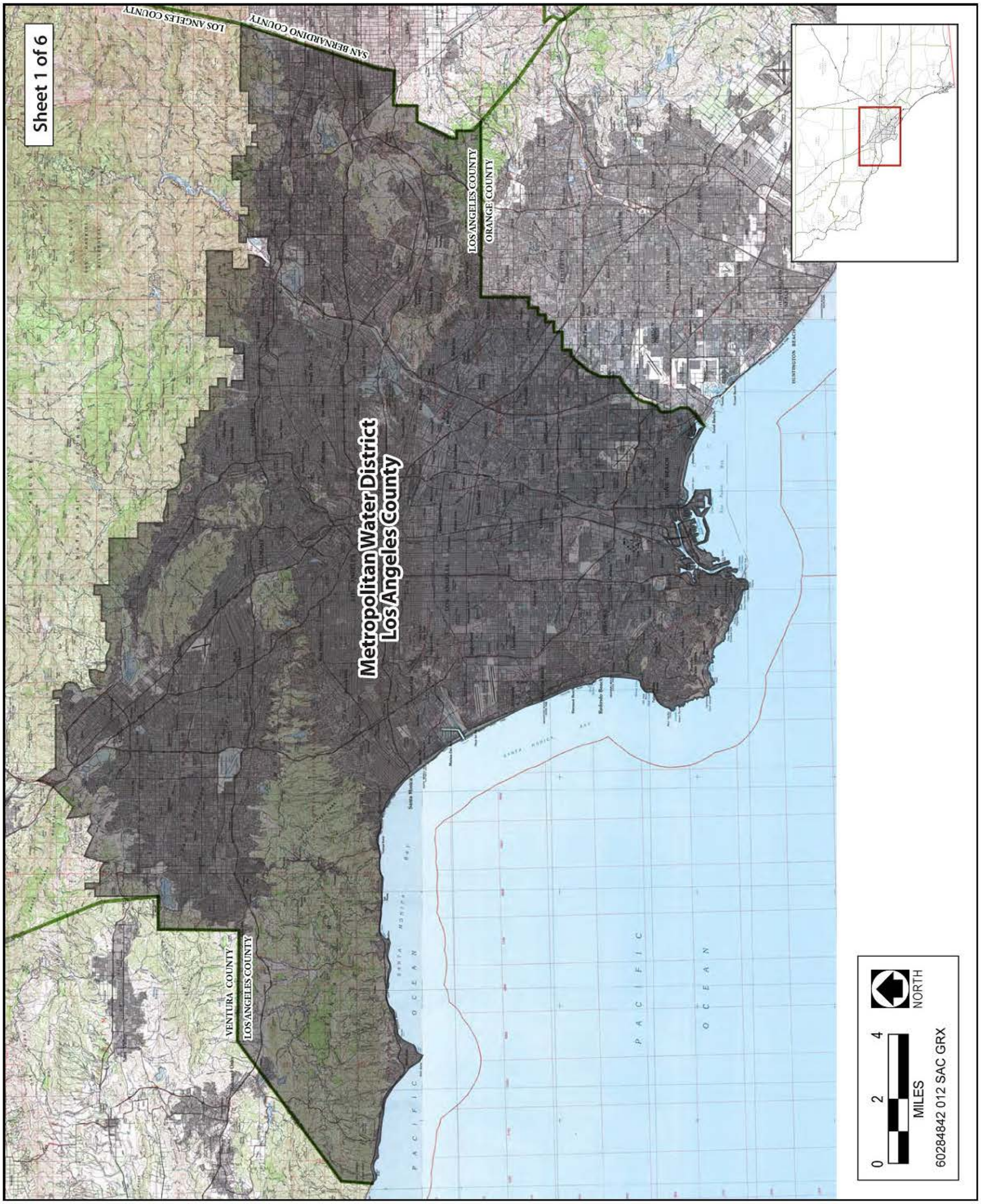
Source: ICF 2010, Adapted by AECOM in 2013

Exhibit 1-10 **Golden State Water Company Region 3 Place of Use**



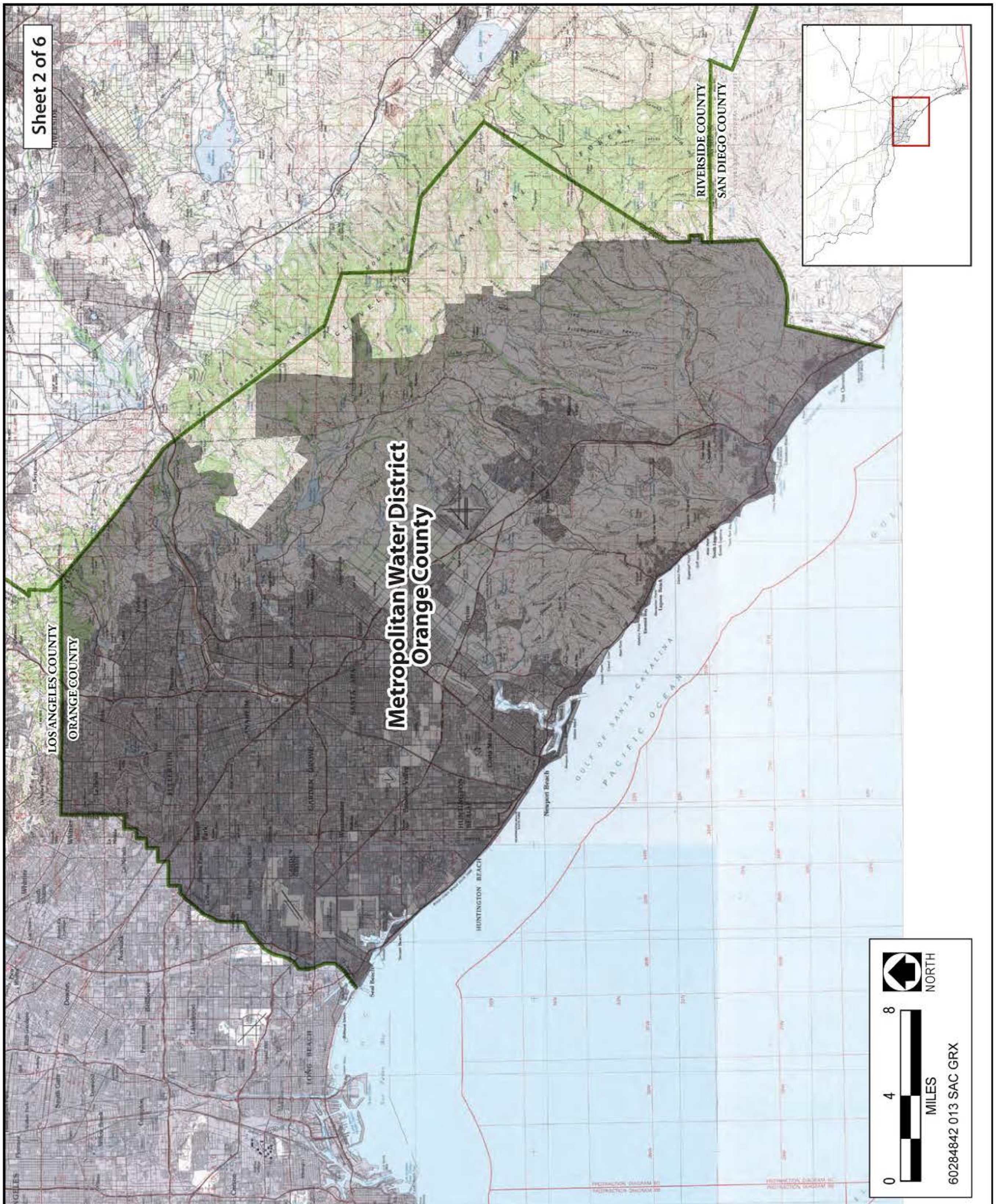
Source: ICF 2010, Adapted by AECOM in 2013

Exhibit 1-11 **Golden State Water Company Region 3 Place of Use**



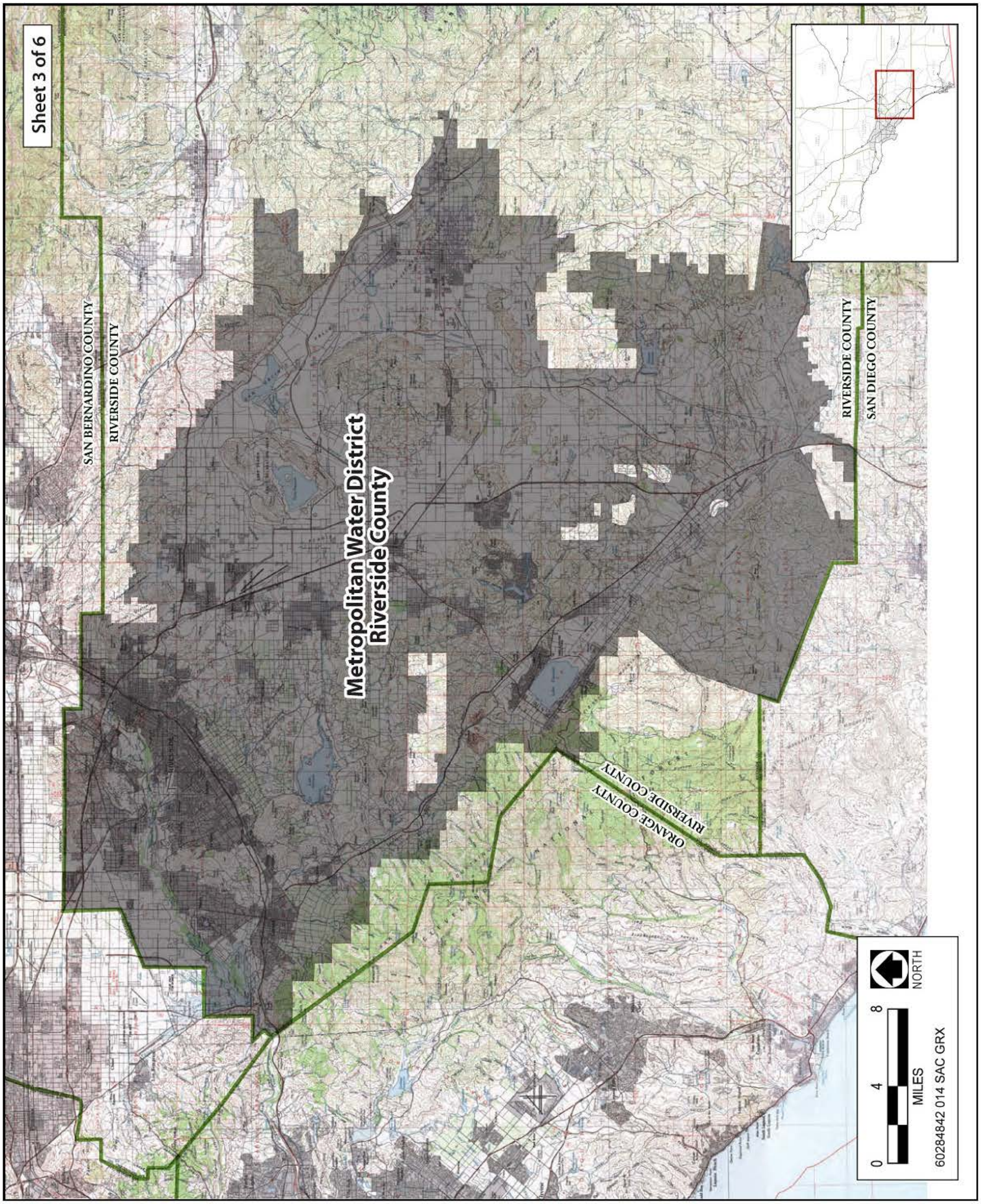
Source: ICF 2010, Adapted by AECOM in 2013

Exhibit 1-12 **Metropolitan Water District Los Angeles County Place of Use**



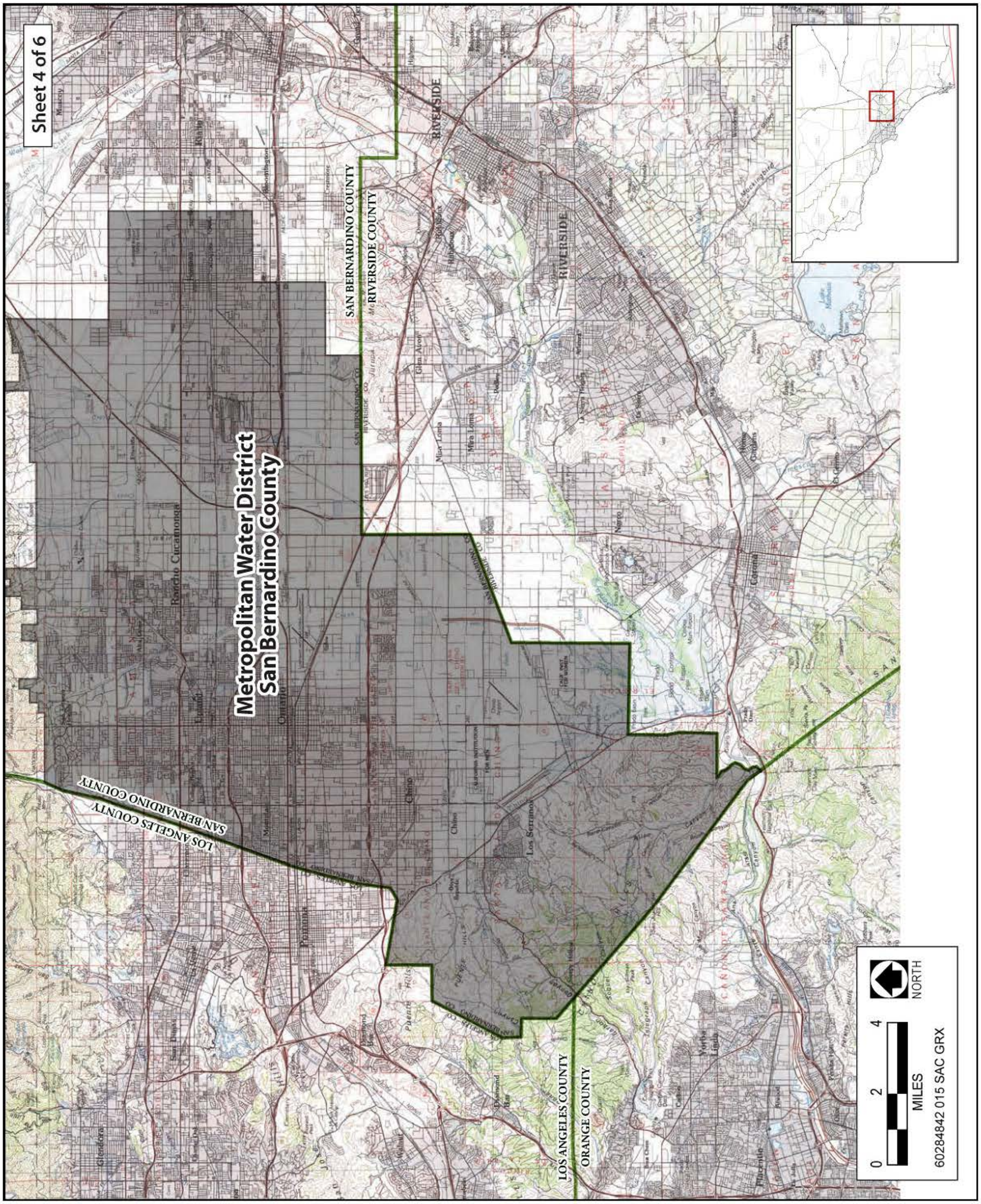
Source: ICF 2010, Adapted by AECOM in 2013

Exhibit 1-13 **Metropolitan Water District Orange County Place of Use**



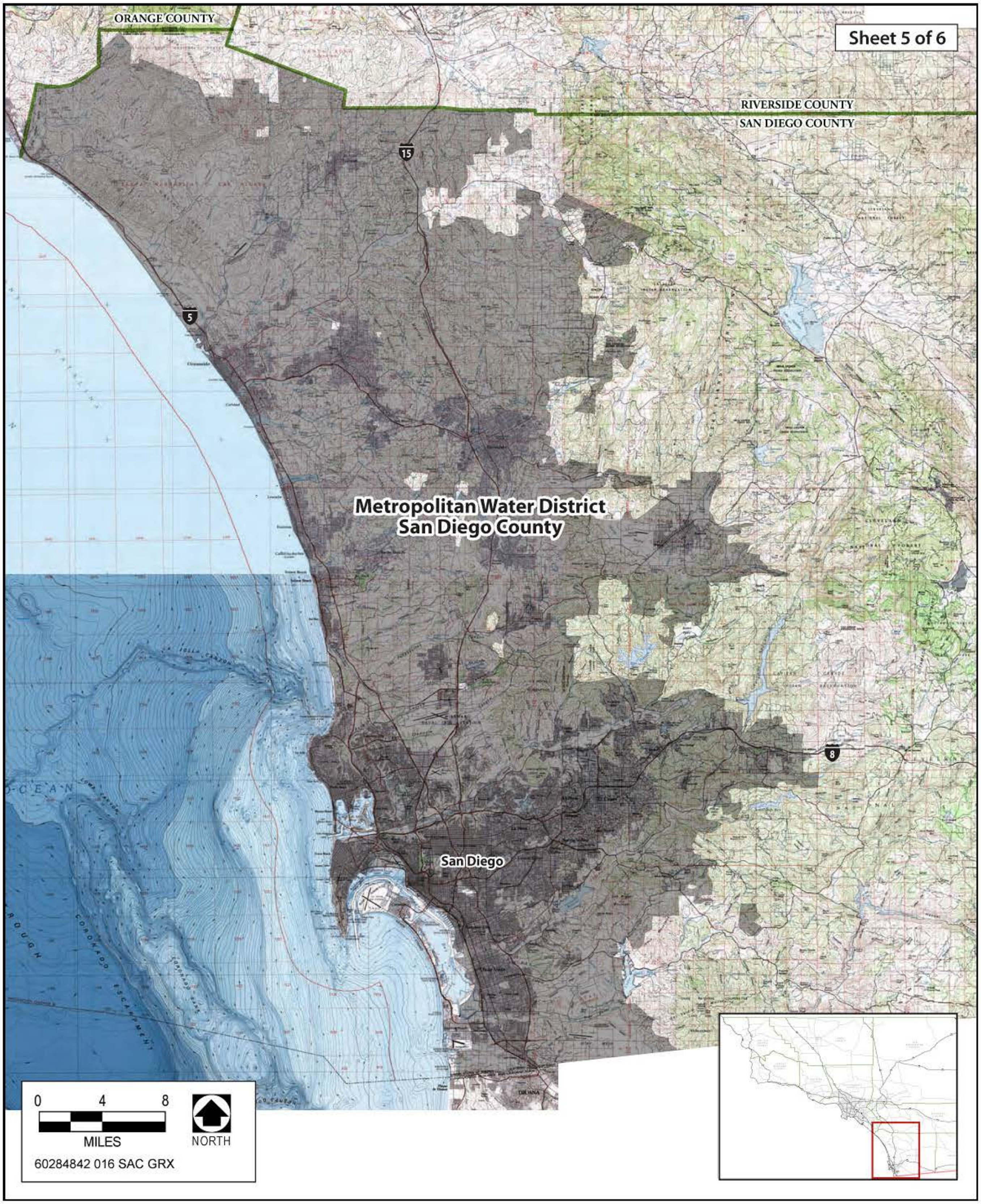
Source: ICF 2010, Adapted by AECOM in 2013

Exhibit 1-14 **Metropolitan Water District Riverside County Place of Use**



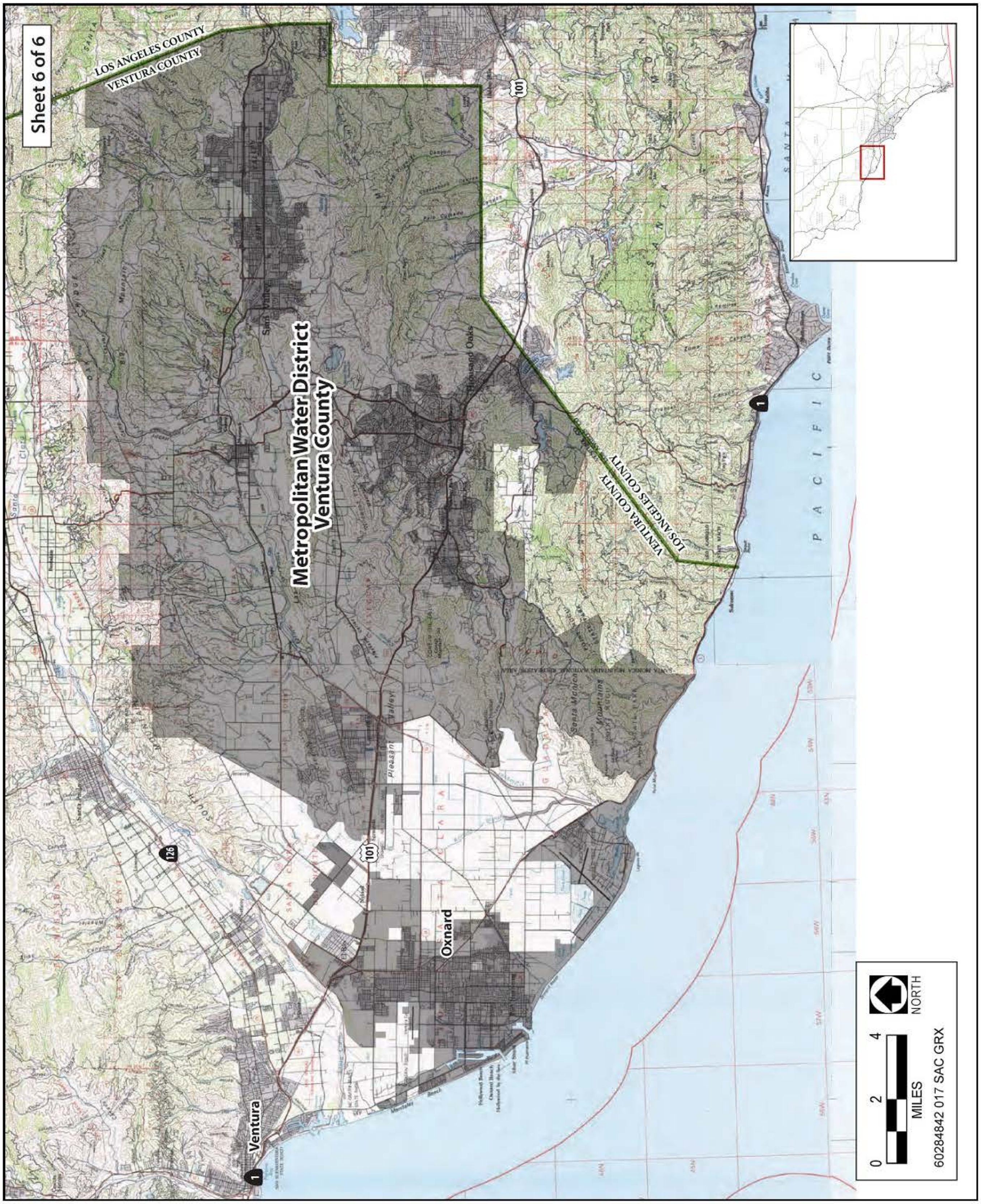
Source: ICF 2010, Adapted by AECOM in 2013

Exhibit 1-15 **Metropolitan Water District San Bernardino County Place of Use**



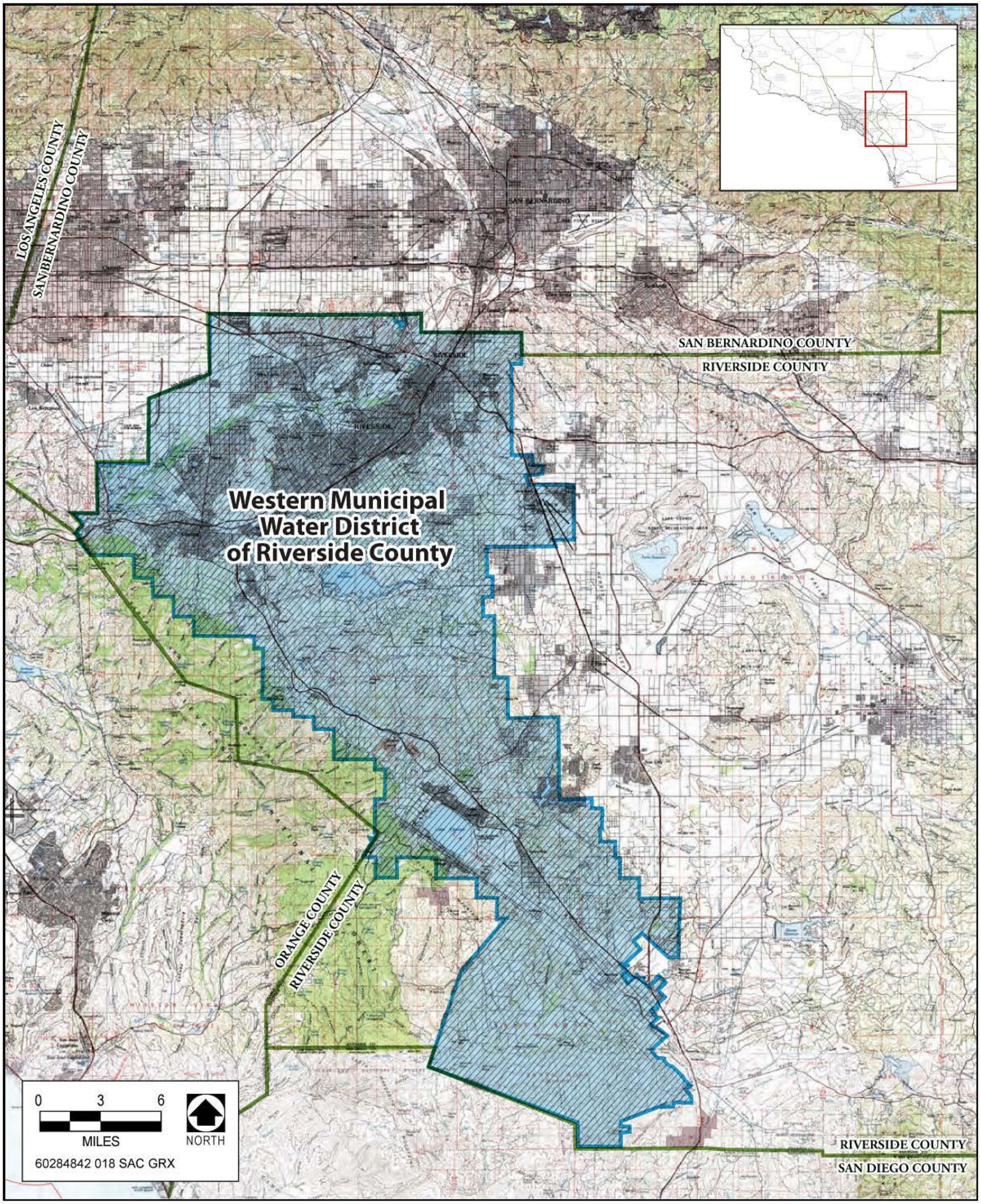
Source: ICF 2010, Adapted by AECOM in 2013

Exhibit 1-16 **Metropolitan Water District San Diego County Place of Use**



Source: ICF 2010, Adapted by AECOM in 2013

Exhibit 1-17 **Metropolitan Water District Ventura County Place of Use**



Source: ICF 2010, Adapted by AECOM in 2013

Exhibit 1-18 **Western Municipal Water District of Riverside County Place of Use**

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2 PROJECT DESCRIPTION AND ALTERNATIVES

2.1 INTRODUCTION

This chapter reviews the basic description of the Proposed Action and three alternatives, and presents in detail the following changes to the project that have been proposed since the 2001 FEIS:

- Specific places of use have been designated for project water to improve the reliability of the existing supplies of water for irrigation and municipal purposes. The designated places of use consist of: (1) Semitropic Water Storage District in Kern County (Semitropic), (2) Metropolitan Water District of Southern California (Metropolitan) and the service areas of its member agencies (which also includes Western Municipal Water District of Riverside County), and (3) Golden State Water Company (Golden State).

- An operational element has been added for banking project water in the Semitropic Groundwater Storage Bank and the Antelope Valley Water Bank for later use by Semitropic, Metropolitan, and other designated users. This allows project water to be stored until there is a water delivery deficit (i.e., unmet existing demand) in the designated places of use.

- The levee design has been revised to improve structural integrity on Bacon Island and Webb Tract (the Reservoir Islands).

- Environmental commitments have been incorporated into the project design to avoid, minimize, and or offset potential environmental effects and therefore are considered as part of the Proposed Action and other action alternatives.

- The construction of new recreational facilities on the Reservoir and Habitat Islands has been removed from the project.

This chapter also summarizes new information and changed circumstances that may affect the existing or future conditions in the Sacramento-San Joaquin Delta (Delta) associated with the Proposed Action and alternatives under consideration.

The operations of the project in the Delta and the operations of the groundwater banks and the monthly deliveries to designated places of use are described in more detail in Section 2.4, "Water Project Operations."

This chapter also provides a summary of the range of reasonable alternatives to the Proposed Action, which were developed consistent with the requirements of 40 Code of Federal Regulations (CFR) 1502.14.

2.2 NEPA AND SECTION 404(B)(1) GUIDELINES – REQUIREMENTS FOR EVALUATION OF ALTERNATIVES

The NEPA Council on Environmental Quality (CEQ) Regulations (40 CFR 15012.14) require that an EIS include:

- an objective evaluation of reasonable alternatives;

- identification of the alternatives considered but eliminated from detailed study, along with a brief discussion of the reasons that these alternatives were eliminated;

- information that would allow reviewers to evaluate the comparative merits of the proposed action (i.e., proposed project) and alternatives;

- consideration of the No-Action Alternative;
- identification of the lead agency's preferred alternative, if any; and
- appropriate mitigation measures not already included in the proposed action or alternatives.

Tthe USACE Section 404(b)(1) Guidelines are the substantive criteria used by USACE in evaluating discharges of fill material into waters of the United States (U.S.) under Section 404 of the Clean Water Act. The guidelines require that the following four criteria be satisfied for USACE to make a decision that a proposed discharge is in compliance:

- The discharge must be the least environmentally damaging practicable alternative.
- The discharge must not violate any water quality standard or toxic effluent standard, or jeopardize the continued existence of a threatened or endangered species.
- The discharge must not result in a significant degradation of the waters of the U.S.
- Unavoidable impacts on the aquatic ecosystem must be mitigated .

Before USACE can issue a permit, it must find that the requirements of the Section 404(b)(1) Guidelines have been satisfied. The key criterion and the focus of the alternatives analysis is the requirement that the discharge be the least environmentally damaging, practicable alternative. USACE considers practicable alternatives to include, but not to be limited to:

- on-site activities that do not include a discharge into waters of the U.S. or ocean waters;
- discharges of dredged or fill material at other locations in waters of the U.S. or ocean waters;
- areas that are not presently owned by the applicant that could be reasonably obtained, used, expanded, or managed to fulfill the basic purpose of the proposed activity (after considering cost, existing technology, and logistics); and
- a project location that does not require access or proximity to or siting within the special aquatic site in question to fulfill its basic purpose (i.e., that is not water dependent). Practicable alternatives that do not involve special aquatic sites are presumed to be available unless clearly demonstrated otherwise. Where a discharge is proposed for a special aquatic site, all practicable alternatives to the proposed discharge that do not involve a discharge into a special aquatic site are presumed to have less adverse impacts on the aquatic ecosystem, unless clearly demonstrated.

The key provisions in the language are "practicability" and "overall project purpose." An alternative is practicable if it is available to the applicant and capable of being accomplished by the applicant after consideration of costs, existing technology, and logistics, in light of the overall project purpose. USACE has determined that the overall project purpose is to increase the availability of high-quality water in the Delta for export or outflow, by storing water on two Reservoir Islands (Webb Tract and Bacon Island) and by doing so, to increase the reliability of water supplies for Semitropic and other places of use including Metropolitan Water District of Southern California, Western Municipal Water District of Riverside County, and Golden State Water Company. If a practicable alternative is identified that would have less adverse impact on the aquatic ecosystem and would not have other significant adverse environmental consequences, then USACE would be unable to issue a permit for the proposed project.

Appendix J contains an alternatives analysis prepared by the applicant that considers a range of alternatives per the requirements of the Section 404(b)(1) guidelines. The analysis contained in Appendix J reevaluated and updated the alternatives analyzed in the previously prepared 1995 Section 404(b)(1) evaluation.

2.3 DESCRIPTION OF PROJECT ALTERNATIVES

The four alternatives evaluated at an equal level of detail in this SEIS are as follows:

- **No-Action Alternative:** the proposed facilities would not be constructed, and the four project islands would continue to be used for intensive agricultural operations.

- **Alternative 1:** an alternative with different operating criteria for diversion and discharge of stored water as compared to the Proposed Action.

- **Alternative 2:** the project as proposed in the 404 permit application (i.e., the Proposed Action).

- **Alternative 3:** an alternative in which all four islands would be used as reservoirs with a limited amount of compensation habitat provided on Bouldin Island.

The project alternatives (Alternatives 1, 2, and 3) and the No-Project Alternative were selected to represent a range of project operations for purposes of determining environmental impacts in compliance with NEPA. All alternatives have been designed to operate within the objectives of the State Water Resources Control Board's (SWRCB) *1995 Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary* (1995 WQCP), adopted May 22, 1995 (and subsequent updates). Each alternative is described in detail in Subsections 2.3.1 through 2.3.4 below. Alternatives that were considered but were not selected for detailed evaluation are described below in Subsection 2.3.5. The proposed operating criteria for Alternatives 1, 2, and 3 are discussed below in Section 2.4, "Water Project Operations."

Complete copies of all of the prior environmental documents cited throughout this SEIS, including the 1995 DEIR/EIS, 2000 RDEIR/EIS, 2001 FEIR, 2001 FEIS, and 2010 DEIR (which are incorporated herein by reference), are available for review on the CDs included with this SEIS.

Each of the action alternatives reference plans that require monitoring, such as the Seepage Monitoring and Control Program, Water Quality Management Plan (including monitoring for dissolved oxygen and temperature), Compensatory Mitigation Plan, Fish Monitoring Plan, Fish Screen Monitoring Plan, and a Construction Monitoring Program (among others). Unless specified otherwise, all monitoring would be carried out by qualified personnel employed by or contracted with Delta Wetland Properties. Where required, monitoring personnel would also be approved by the appropriate resource agencies, including, but not limited to, California Department of Fish and Wildlife (DFW), SWRCB, USACE, U.S. Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS), and U.S. Environmental Protection Agency (EPA).

For readability, all exhibits are located at the end of each chapter and section of this SEIS, rather than interspersed throughout the text of each chapter/section.

2.3.1 NO-ACTION ALTERNATIVE

The No-Action Alternative has not changed since publication of the 2001 FEIS. If USACE permit applications or SWRCB water right permit applications for the project are denied, the project applicant would implement intensive agricultural operations on the four project islands or sell the property to another entity that would likely implement intensive agriculture. The No-Action Alternative is based on the assumption that intensified agricultural conditions represent the most realistic scenario for the project islands if permit applications are denied.

Private hunting opportunities on the project islands already occur under existing conditions; under the No-Action Alternative, a more intensive for-fee hunting program would be operated on the project islands. The project applicant estimates that this intensified hunting program would create an additional 12,000 hunter-use days as compared to existing conditions. No new recreation facilities would be constructed on any of the project islands.

Changes in project island operations under the No-Action Alternative would be limited to those farming activities that increase cropping intensity and could be implemented without a permit issued by USACE or SWRCB. The cropping scenario for this alternative is described in Section 3.2, “Agricultural Resources.” The No-Action Alternative would entail implementing more efficient drainage and weed management practices on Holland and Webb Tracts and shifting some crop types on Bacon and Bouldin Islands.

Under the No-Action Alternative, consumptive use would increase, reflecting more extensive agricultural use of the islands, but not measurably so at the scale of monthly water supply modeling. The currently existing siphon facilities on the islands, which are unscreened, would not be modified under the No-Action Alternative.

2.3.2 ALTERNATIVE 1

Alternative 1 and Alternative 2 both entail construction of the same facilities in the same locations; these facilities are fully described below in Subsection 2.3.3, “Alternative 2 (Proposed Action).” Alternative 1 differs from Alternative 2 only with regard to the operating criteria for export of stored water. The export/import (E/I) ratio in the 1995 WQCP limits Central Valley Project (CVP) and State Water Project (SWP) exports to specified percentages of Delta inflow. The current definition of E/I may not recognize water released from in-Delta storage as a source of inflow. The project applicant has requested that SWRCB revise the E/I definition as part of its ongoing review and update of the 1995 WQCP. If the E/I definition is revised to consider Delta Wetlands discharges, allowable project-related exports would also increase accordingly (i.e., Alternative 2). If the E/I definition is not revised to account for Delta Wetlands project discharges, then CVP and SWP export of Delta Wetlands project discharges would remain limited by the applicable E/I ratio (i.e., Alternative 1). Therefore, the operating criteria for Alternatives 1 and 2 are based on different interpretations for the method of applying the export limits specified in the 1995 WQCP to discharges of water from the project islands. The Delta Wetlands project discharges to export may therefore:

- count toward the percentage of inflow that is allowed to be exported (i.e., may be subject to strict interpretation of the export limits) (this is evaluated as Alternative 1); or
- be in addition to the percentage allowed under the export limits (i.e., may not be subject to strict interpretation of the export limits) (this is evaluated as Alternative 2).

For Alternative 1, discharges of water from the Reservoir Islands would be exported in any month when unused capacity within the permitted pumping rate exists at the SWP and CVP pumps and when strict interpretation of the export limits (i.e., percentage of total Delta inflow, or “percent inflow”) specified in the 1995 WQCP does not prevent use of that capacity. Such unused capacity could exist when the amount of available water (i.e., total inflow less Delta outflow requirements) is less than the amount specified by the export limits. In contrast, under Alternative 2 (the Proposed Action), the export of project discharges would be limited by the 1995 WQCP Delta outflow requirements and the permitted combined pumping rate of the export pumps, but would not be subject to strict interpretation of the 1995 WQCP “percent of inflow” export limit. Please see Subsection 2.4.7 “Simulated Project Operations for Water Years 1980-2003” for more details regarding operations of the project under each alternative.

Under Alternative 1, project discharges would be treated as additions to total Delta inflow. Export of project discharges thus would be limited to the lesser of the permitted export pumping capacity and the amount calculated under the strict interpretation of the export limits (i.e., the “percent inflow” export limit), based on the adjusted inflow amount.

Restrictions that further limit discharges from the Reservoir Islands are discussed below in Subsection 2.3.7, “Environmental Commitments” and in Section 2.4, “Water Project Operations.” Copies of the full text of the final operations criteria (FOC), biological opinions (BOs), and stipulated agreements between Delta Wetlands Properties and other parties to the SWRCB’s water right hearing are herein incorporated by reference and are included with this SEIS on CDs (see Appendices A through E in the 2000 RDEIR/EIS and Volume 2 of the 2001 FEIS, “Appendix to the Responses to Comments”).

2.3.3 ALTERNATIVE 2 (PROPOSED ACTION)

The project would increase the availability of high-quality water in the Delta for export or outflow by storing water on two Reservoir Islands (Bacon Island and Webb Tract, see Exhibits 2-1 and 2-2) and would compensate for wetland and wildlife effects of the water storage operations on the Reservoir Islands by implementing a Compensatory Mitigation Plan (CMP) on two Habitat Islands (Bouldin Island and Holland Tract, see Exhibits 2-3 and 2-4). The monthly operations of the project are described below in Section 2.4, “Water Project Operations.” All the land required for the project is currently owned by Delta Wetlands Properties.

In summary, during periods of availability throughout the year, water would be diverted onto the Reservoir Islands to be stored for later sale or release. Water would be discharged from the Reservoir Islands into Delta channels for sale for beneficial uses for export or for Bay Delta estuary needs during periods of demand throughout the year, subject to state and Federal regulatory standards and the terms of the project FOC, BOs, and stipulated agreements between the project applicants and other parties to the SWRCB’s water rights hearing. Project water discharged into the Delta channels would mix with Delta inflows from the Sacramento and San Joaquin Rivers and other tributary rivers and would be available as either export water or Delta outflow (e.g., outflow necessary to satisfy 1995 WQCP objectives or other state or Federal standards). Project operations would be adjusted on a daily basis according to hydrologic information and information on fish abundance and location obtained through monitoring.

Water would be diverted onto the Habitat Islands to be used for agriculture related to wetland and wildlife habitat creation and management during periods of availability and need. Most likely, the water diversions for wetland management on the Habitat Islands would begin in September and water would be circulated throughout winter. Except for small areas of permanent water, water used on the Habitat Islands for wetland and wildlife habitat would be discharged on a schedule related to wetland and wildlife values, with drawdown typically by May to promote vegetation growth. Some background information about the Delta and the project islands is presented below to provide a framework for understanding the existing conditions of these project islands and the proposed conversion to in-Delta Reservoir Islands and Habitat Islands. (More detailed descriptions of existing conditions on the project islands and tracts are provided in each topic impact section in Chapter 3.) Additional project details are provided below.

PROJECT ISLAND CHARACTERISTICS

The Delta generally can be best depicted with a series of maps and tables in the Delta Atlas (California Department of Water Resources [DWR] 1995). The total area within the legal Delta boundary is approximately 738,000 acres (approximately 1,503 square miles). The Delta is primarily composed of agricultural lands (approximately 538,000 acres) and tidal water channels (approximately 61,000 acres). According to the Delta Atlas, which was prepared in 1995, approximately 65,000 acres of agricultural lands are located in towns and cities and approximately 75,000 acres of agricultural lands are undeveloped. However, since Liberty Island in the north Delta flooded in 1997, water now covers approximately 65,000 acres, agricultural land has been reduced by about 4,000 acres,slightly modifying the values that were provided in the Delta Atlas in 1995.

The Delta land areas are protected with levees, and the Delta Atlas indicates that there are approximately 1,100 miles of levees in the Delta. The levee system is primarily maintained by local reclamation and levee districts.

The levees for the project islands are in this category and are maintained by four reclamation districts (one for each island or tract), as discussed below.

Bouldin Island levees are maintained by Reclamation District 756. Bouldin Island has 18 miles of levees with an area of 6,006 acres, bisected by State Route (SR) 12 (about 80 percent of the island is south of SR 12). Holland Tract levees are maintained by Reclamation District 2025, with 11 miles of levees and 4,060 acres. Webb Tract levees are maintained by Reclamation District 2026, with 13 miles of levees and 5,490 acres. Bacon Island is maintained by Reclamation District 2028, with 14.3 miles of levees and 5,625 acres (California Department of Water Resources 1995: Table 1). Exhibits 1-1 and 1-2 (in Chapter 1, "Introduction") show a map of the Delta and identify the location of the project islands and tracts.

The project islands and tracts cover a total of about 21,180 acres, which is about 4 percent of the Delta agricultural land. The levees on the project islands and tracts total 56 miles, which is about 7 percent of the Delta levees not part of the Sacramento –San Joaquin Federal Flood Control Project. Flooding has occurred historically in the Delta, due to high water overtopping levees during major flood events and other levee failures (like the Jones Tract June 2004 flooding). Since 1930, Bouldin and Bacon Islands have not flooded. However, Webb Tract levees failed in the flood of 1950, and both Webb and Holland Tract levees failed in the flood of 1980 (California Department of Water Resources 1995: 46–48).

Land surface elevation has subsided during agricultural uses since the Delta islands and tracts were reclaimed with levees during the 1870–1920 period. The general depth of subsidence on Bacon Island and Webb Tract (Reservoir Islands) is about -15 feet above mean sea level (msl), with minimum elevations of -18 feet msl (California Department of Water Resources 1995: 30). The subsidence on Bouldin Island is also about -15 feet msl (minimum elevations of -17 feet), while the subsidence on Holland Tract is -10 to -15 feet msl (minimum elevations of -16 feet msl). With project levee improvements to store water to +4 feet above mean sea level, Bacon Island and Webb Tract would have a combined storage capacity of 215 thousand acre-feet (taf).

RESERVOIR ISLANDS

Bacon Island and Webb Tract would be managed as Reservoir Islands for water diversion, storage, and discharge. The project life-cycle for this use is planned for 50 years. Facilities needed for project operations consist of intake siphon stations with fish screens and auxiliary pumps to divert water onto the Reservoir Islands, pump stations to discharge stored water from the islands, and improvements to the existing levees, as discussed in further detail below.

The maximum water storage elevation analyzed in the 2001 FEIS was +6 feet msl (National Geodetic Vertical Datum 1929 [NGVD 29]). The Reservoir Islands are now are designed for water storage levels up to a maximum elevation of +4 feet (NGVD 29), providing a total estimated storage capacity of 215 taf, with approximately 115 taf on Bacon Island and approximately 100 taf on Webb Tract.

Diversion Facilities

Two diversion stations with 16 siphons per station would be constructed on both Webb Tract and Bacon Island, for a total of 64 new siphons. Each siphon would have 36-inch-diameter pipes diverting water from the adjacent channel. Positive barrier fish screens to prevent entrainment of fish in project diversions would be installed around the intake end of each siphon pipe as specified in the project-related FOC and BOs (described in detail in Section 3.4, "Aquatic Resources"). Some of the existing siphon facilities on the project islands would be removed; of those that remain, fish screens would be installed. Fish screens would also be installed on all proposed new siphons. Siphons would also include flow control valves, inline booster pumps, and expansion chambers at the discharge end of the siphon pipe. The individual siphons would be spaced at least 40 feet apart to incorporate fish screen requirements. The proposed locations of diversion stations are shown in Exhibit 2-1 for Bacon Island and in Exhibit 2-2 for Webb Tract.

Each siphon station would include a boat dock (maximum 10 berths) for use by maintenance personnel; a maintenance facility, including a vehicle parking area and living quarters or office space constructed on a pile foundation; and an access ramp near the maintenance facility for equipment loading from the levee road. A minimum of two hinged gangway access ramps would also be constructed adjacent to siphon units for repair access. Each siphon station would be constructed along approximately 900 feet of the perimeter levee and would cover approximately 150,000 square feet (about 3.4 acres). Exhibit 2-5 provides a siphon station plan view.

Exhibit 2-6 shows a conceptual siphon unit profile. Each siphon unit would consist of the following components:

- a siphon inlet equipped with a fish screen module submerged in the adjacent channel;
- a 36-inch-diameter rigid pipe constructed along the exterior slope of the perimeter levee from the inlet structure to the levee top and installed through the top of the levee to the interior slope;
- a 36-inch-diameter flexible, high-density polyethylene pipe constructed along the interior slope from the levee top into the island interior;
- an expansion chamber supported by a floating platform connected to the flexible pipe in the island's interior; and
- a siphon unit control valve and optional booster pump.

Guard piles would be constructed in the channels beyond the inlets to protect the siphon units. A standpipe used to attach the vacuum pump used to start each of the siphons would be located at the highest elevation of each siphon pipe where it crosses the levee. During operation start-up and shut-down, siphon units would be started and stopped sequentially in each station to avoid creation of bore waves and surges in adjacent channels. Maximum water velocities in the siphon barrels would be approximately 27-29 feet per second (fps).

The flexible pipe constructed along the interior slope of the levee would connect the rigid pipe to the siphon discharges on the island interior. Concrete tracks constructed on the interior slope would support the flexible pipes. The pipes would be equipped with flow meters as required.

The siphon discharges on the Reservoir Island interiors would be connected to the expansion chambers supported by floating platforms. The expansion chambers would allow the siphon pipes to expand from a 36-inch diameter to a 36- by 120-inch rectangular opening to disperse high-velocity flows and reduce erosion of the reservoir bottoms. Sheet piling or riprap on the island floors also would be used to prevent erosion around the discharge ends. Siphon discharges would be equipped with hinged flap gates to prevent backflow.

In the final stages of reservoir filling, the siphons would be subject to a maximum total head condition ranging from 8 feet at low tide with a full reservoir to a vacuum of 6 feet at high tide with a partially full reservoir. Booster pumps, powered by 50- to 75-horsepower motors, could be installed on the pipes in the floating siphon support platforms to lift water several feet above mean sea level in the final stages of diversions. The booster pumps would be an option to facilitate siphon capacity and may not always be included in the siphon design. Expansion chambers would be fitted to the discharge ends of the siphons on the interiors of the islands, and contraction chambers would be fitted to the inlet ends in Delta channels. These chambers would increase the efficiency of siphon operation and decrease exit velocity of water from the siphon onto the islands. Sheet piling or riprap would be used to prevent erosion around the discharge ends of the siphons.

The diversion siphons would be screened for fish protection. The fish screens would be designed and operated to meet USFWS criteria for delta smelt (0.2-feet/second [ft/sec] approach velocity) and would incorporate a drum design to minimize the length of exposure, drawing water from all directions. The positive barrier fish screens would be constructed using a cylindrical wedge-wire design with a maximum screen mesh opening of 1.75 millimeters (mm) and a maximum design approach velocity of 0.2 ft/sec. The intake screens have a capability of being set for 5-minute cleaning intervals if necessary, but would be cleaned in accordance with current USFWS/NMFS/DFW criteria whenever the diversion is in operation. The fish screens would be inspected at least annually for screen mesh integrity and routine maintenance. As a result of the tidal hydrodynamics near the project islands, fish screen sweeping velocities would be bi-directional and would vary based on tidal and local hydrodynamic conditions.

Diversion rates of water onto the Reservoir Islands would vary with pool elevation and water availability. The maximum daily diversion onto either Webb Tract or Bacon Island would be approximately 3,000 cubic feet per second (cfs) (i.e., 6 taf per day). The diversion rate would be reduced as the reservoirs fill, and booster pumps would be used to complete the filling process. The combined maximum monthly diversion rate would be approximately 3,800 cfs, provided that all terms and conditions set forth by the project applicant's water rights, the FOC, BOs, and stipulated agreements with other parties to the SWRCB's water right hearing are satisfied.

Discharge Facilities

One discharge pump station with 32 new pumps would be constructed on Webb Tract, and one pump station with 32 pumps would be constructed on Bacon Island, for a total of two pump stations and 64 discharge pumps. Pumps would be either electrically powered or diesel powered. Each pump would have 36-inch-diameter pipes discharging to adjacent Delta channels. Typical spacing for the pumps would be 25 feet on center. An assortment of axial-flow and mixed-flow pumps would be used to accommodate a variety of head conditions throughout drawdown. As water levels decrease on the Reservoir Islands, the discharge rate of each pump also would decrease. The pump station pipes would discharge underwater to adjacent Delta channels. The proposed locations of discharge stations are shown in Exhibit 2-1 for Bacon Island and in Exhibit 2-2 for Webb Tract.

Each pump station also would include a boat dock (maximum l 0 berths) on the Delta channel side for use by maintenance personnel, a maintenance facility and vehicle parking area constructed on a pile foundation on the interior side of the levee, and an access ramp near the maintenance facility for equipment loading from the levee road into the island interior. A minimum of one gangway access ramp per eight pumps would be installed adjacent to pump units for repair and maintenance access. Each pump station would be constructed along approximately 1,000 or 1,250 feet of the perimeter levee (the length depending on the number of pump units per station) and would cover approximately 180,000 or 220,000 square feet (about 4 or 5 acres). A pump station plan view is presented in Exhibit 2-7.

Exhibit 2-8 shows a conceptual design of a pump unit. Each pump unit would consist of the following components:

- a discharge pump (diesel- or electric-powered) supported by a floating platform equipped with a trash screen bottom to minimize the amount of debris entering the pipe from the reservoir island;
- a 36-inch-diameter flexible, high-density polyethylene discharge pipe constructed along the interior slope of the perimeter levee from the discharge pump unit to the levee top;
- a 36-inch-diameter rigid pipe with a siphon breaker installed through the levee top and along the exterior slope of the levee down into the channel; and
- an expansion chamber connected to the discharge end of the rigid pipe in the adjacent Delta channel.

An assortment of axial-flow and mixed-flow pumps would be used to accommodate the variety of head conditions occurring throughout reservoir drawdown. Head conditions would vary from a maximum total head condition of 31 feet at high tide with an empty reservoir to a vacuum of approximately 6 feet with a full reservoir. The floating platforms would be equipped with trash racks and trash screens to minimize the amount of debris that enters the inlet pipes.

The rigid discharge pipes would connect the flexible pipes constructed along the interior levee slope to the floating pump platforms. Concrete tracks would provide support for the flexible pipes. A siphon breaker and relief valve would be installed at the highest elevation of each discharge pipe to prevent backflow when pumps are not operating. Flow meters would be installed as required.

Outside each island perimeter levee, the 36-inch-diameter rigid pipes passing through the top of the levee would continue along the exterior levee slope into the Delta channel where the discharge ends would connect with expansion chambers. The expansion chambers would allow the pipes to expand from a 36-inch-diameter to a 36- by 120-inch-rectangular opening. Guard piles would be constructed in the channel beyond the expansion chambers to protect the units, and riprap would be placed on the channel bottom to protect against erosion from the units.

Pump units would most likely be powered by electricity because it is available on both Reservoir Islands; however, diesel fuel, electricity, natural gas, or a combination of the three are possible power sources. If electrical power is used for pump stations, project pump operations may need to avoid peak electrical demand periods during summer, requiring up to 25% more pumping capacity from an alternate power source or through other facilities (e.g., portable pumps). If diesel fuel is used either as the primary or secondary power source, a diesel fuel distribution system would be located on the levee tops with a distribution system of pipes and hoses to deliver fuel to the pump motors. A fuel spill recovery system would be implemented at all areas using diesel fuel. As a supplement to discharge pumping activity, portable pumps or components may be used on the Reservoir Islands to meet varying discharge requirements but not to exceed the maximum specified discharge rate. The portable components would serve as replacement components and would not add to the permanent facility installation.Project water would be discharged for export during periods of water demand in designated places of use or for groundwater bank recharge, subject to Delta regulatory limitations, export pumping capacities, and restrictions imposed by the FOC, BOs, and the project applicant's stipulated agreements. The discharge for water export and delivery to designated places of use would occur from July through November, with most exports occurring during the July–September water transfer window. The discharge for delivery to recharge the groundwater banks likely would be in the fall months. Project discharges for export would be pumped at a maximum daily rate of approximately 4,000 cfs for the two islands. Actual discharges would be based on available export capacity, and average discharges are anticipated to be considerably less than 4,000 cfs.

Project water that cannot be exported because of permitted pumping limits (limited unused capacity) likely would be discharged for increased Delta outflow to reduce Delta (and export) salinity in September, October, and November. When there are diversions to storage, the Reservoir Islands would be emptied at the end of each year to reduce the accumulation of salinity and total organic carbon in the stored water, and refilled during winter high-flow events. Since this stored water would have lower salinity than the surrounding aquatic environment at this time of year, these discharges would have beneficial effects on water quality.

There would be no planned discharges in years without diversions to storage. There may be periodic discharges during non-storage periods for routine maintenance; however, these discharges would be substantially less in volume and frequency when compared to existing conditions.

Levee Improvements and Operations and Maintenance

The project-related conversion to Reservoir Islands and Habitat Islands would include strengthening and maintaining 56 miles of levees. The interior of the levees on the Reservoir Islands would be improved to resist the stresses and erosion potential of wind-waves and water level drawdown, as discussed in detail below.

Under existing conditions, levee conditions are greatly variable. A typical present levee condition consists of a 20-foot-wide crest at an approximate elevation of +8.5 feet above mean sea level with an exterior (water side) slope of 2:1 (horizontal to vertical) and an interior (land side) slope of 4:1. Project-related improvements would result in a typical levee with 2:1 exterior slopes and a crest approximately 45 feet wide (including thickness for erosion protection [rock revetment] on the interior slope) at approximately +9 feet elevation. The interior slopes of the perimeter levees would be modified with either a constant-slope buttress or a broken-slope buttress design, as depicted in Exhibit 2-9. The broken-slope buttress design would have initial interior slopes of approximately 3:1 down to near an elevation of -3 feet and toe berms at a 10:1 slope at the base of the levee. The levee crest would be surfaced with an all-weather access road. The 45-foot-constructed crest width provides room for additional fill in anticipation of postconstruction settling. The wider initial levee top width would allow future maintenance activities to place material to increase heights to accommodate anticipated settling and sea-level rise, while still providing minimum top widths and acceptable side slopes after the material placement. This design also includes the addition of a core trench to reduce through-levee seepage potential, thereby increasing stability and safety. This proposed design is also similar to the geometric recommendations put forth in a report that investigated the levee stability of a "seismically repairable" levee, using Webb Tract for the analysis (Hultgren-Tillis 2009a). The seismically repairable geometry included similar crest width and side slopes and was found to perform well during large seismic events, allowing for quick repairs and increased stability. Water will not be impounded to a depth that is greater than +4 feet (NGVD 29). Final levee design would be subject to engineering review.

The interior slopes of these perimeter levees would be protected from erosion by conventional rock revetment similar to that used on existing exterior slopes, or by other conventional systems such as soil cement or a high-density polyethylene liner. In areas where final design studies indicate that wave splash and runup could potentially erode the levee crest if it is unprotected, the levee crest would be hardened or the erosion-protection facing would be extended up as a splash berm.

Most of the material for levee improvements would be borrowed from the Reservoir Islands. Borrow requirements for the project consist of excavation for levee buttressing, inner levee construction, and levee maintenance. Excavation for construction of drainage canals and circulation ditches on the project islands would also provide some of the borrow material. Borrow pits would initially be shallow but would be used regularly in the future for maintenance requirements. Exact locations of borrow sites would vary according to material requirements for construction and maintenance. Borrow area locations are primarily a function of existing soil conditions and would be determined during site-specific engineering surveys. Each borrow area would generally be located more than 1,000 feet inward from the toe of a levee so that the borrow excavation would not cause adverse structural effects on the levee and would be at least 2,000 feet inward from the final toe of an improved levee where a greater setback is necessary to control seepage. This would require approximately 2,634,868 cubic yards of borrow material for Web Tract and approximately 3,316,967 cubic yards for Bacon Island. Erosion control material (e.g., rock revetment) would be quarried from existing regional quarry sites. Levee construction would require approximately 470,000 tons of rock for Bacon Island and approximately 450,000 tons of rock for Webb Tract.

The project includes a seepage-control system that would consist of interceptor wells installed in the exterior levees of the Reservoir Islands in locations where substantial seepage to adjacent islands through subsurface materials is predicted to occur (Exhibit 2-10). Water captured by the interceptor wells would be pumped back into the reservoirs. The interceptor wells would be used to maintain the hydraulic heads in subsurface materials within preproject ranges at distances of 500 to 1,000 feet from the project island perimeters (i.e., beneath levees of adjacent islands).

The project would implement a seepage monitoring program to provide early detection of seepage problems caused by project operations (Exhibit 2-10). A network of wells (i.e., piezometers) located immediately across the channels from the Reservoir Islands would be used to monitor seepage; background wells at distant locations would establish water level changes that typically occur without project operations. Delta Wetlands has proposed seepage performance standards for the project that would be used to determine the amount of interceptor-well pumping needed to ensure that seepage is reduced to acceptable levels. The seepage monitoring program is discussed in further detail below in Subsection 2.3.7, "Environmental Commitments."

CALFED and DWR have adopted Public Law (PL) 84-99 (the Flood Control and Coastal Emergency Act) as the preferred design standard for Delta levees. Therefore, all project levees would be designed to meet or exceed PL 84-99 levee geometry standards at the time of construction. Levee design would control wave erosion through placement of rock revetment on the inside slopes of the perimeter levees. Project-related seepage would be controlled with a slurry wall and an extensive monitoring and shallow groundwater pumping system. During project operation, the perimeter levees would be inspected weekly to identify any erosion, cracking, or seepage problems. Ongoing maintenance activities on the levees would include periodic placement of fill material, placement or installation of erosion protection material, reshaping or grading of fill material, vegetation control, and regrading or repairing the levee road surface. Each island's Reclamation District would remain responsible for levee operation and maintenance for flood control after development of the project.

Operation and maintenance activities for the Reservoir Islands would include the following:

- operation of on-site siphons and pumps during water diversions and discharges;
- inspections and maintenance of perimeter levees, including placement of fill and rock revetment as needed;
- maintenance of inner levees for management of reservoir bottoms;
- water quality monitoring;
- maintenance and monitoring of siphon units and fish screens; and
- inspections and maintenance of pump and siphon stations.

Recreation Facilities

The project has been changed and no longer includes the construction of any new recreational facilities on the Reservoir Islands.

HABITAT ISLANDS

Bouldin Island and Holland Tract would be dedicated to and managed for wetlands and other wildlife habitat and vegetation (see Exhibits 2-3 and 2-4). The primary function of the Habitat Islands, as described in the draft CMP (attached as Appendix B), is to offset effects of water storage operations on listed Threatened and Endangered species, and on waters of the United States (including wetlands) pursuant to Section 404 of the Clean Water Act (CWA), and to provide other enhanced and dedicated wildlife habitat areas for wintering waterfowl and support limited hunting opportunity. The Habitat Islands would be developed and managed to provide breeding and foraging habitat for special-status wildlife species and other important wildlife species groups.

Wetland management on the Habitat Islands would require grading, planting, and seasonally diverting water. Improvements would be made to existing siphon and pump facilities and to perimeter levees, including buttressing levees, to provide for levee stability and flood control. No new siphon or pump stations would be constructed on the Habitat Islands. Some of the existing siphon facilities on the project islands would be removed; of those that remain, fish screens would be installed. Fish screens would also be installed on all proposed new siphons. The project has been changed and no longer includes the construction of any new recreational facilities on the Habitat Islands. The Bouldin Island airstrip would be operated to support project operations and maintenance activities. The dedication of the two habitat enhancement islands is considered an environmental commitment of the project (see Subsection 2.3.7 below) and is more fully described and evaluated in Section 3.4, "Aquatic Resources" and Section 3.5, "Biological Resources."

The draft CMP presents data related to the existing wetlands and other waters of the U.S., along with expected acreage that would be filled, on all four project islands. The proposed created and preserved habitat acreages are presented in detail in the Conceptual Restoration Plans for Bouldin Island and Holland Tract (included as Exhibits 1 and 2 to the draft CMP). The Conceptual Restoration Plans provide descriptions and analyses of proposed locations for wetland creation and habitat conversions on both Habitat Islands. The draft CMP and the Conceptual Restoration Plans also address effects to special-status terrestrial and aquatic species, and the design of created habitat. Agricultural crops on Bouldin Island would be managed to provide high-quality foraging habitat for Swainson's hawk; additional types of foraging habitat would also be provided on Holland Tract. In addition, some of the agricultural land would be dedicated to the maintenance of farmed wetlands. Performance standards have been established for the created and preserved wetland, aquatic, and upland habitat, and are discussed in detail in the draft CMP. The performance standards provide the basis for annual monitoring parameters and would help determine the need for possible remedial actions after project implementation. Monitoring and reporting protocols that would be implemented for 10 years following project implementation are described in detail in the draft CMP. Annual reports would be submitted each year by the project applicant to USACE, DFW, and USFWS, as required. Long-term maintenance and management of the Habitat Islands would be directed by a final CMP. The final CMP would outline the methods for ensuring the long-term success of compensation and protection of wetlands and other waters of the U.S. and special-status species habitat on the Habitat Islands. Funding for long-term management and maintenance of the Habitat Islands would be established prior to project implementation; the process and requirements for long term funding are described in the draft CMP. The Habitat Islands would be permanently protected by conservation easements held by DFW or an entity approved by USFWS, DFW, and USACE.

Installation and construction of created habitats on the Habitat Islands would occur during construction of the Reservoir Islands; all earth moving, contouring, planting, and water management planning and infrastructure for the created and preserved habitats on the Habitat Islands would be completed prior to the operation of the Reservoir Islands.

The Conceptual Restoration Plans for Bouldin Island and Holland Tract are intended to 1) demonstrate where habitat would be created and/or restored, and 2) provide the basis for future design efforts needed forconstruction on the Habitat Islands. The plans describe the goals, existing conditions, and species habitat requirements, and then describe the methods used to develop the conceptual design. Lastly, the plans describe the draft conceptual design for each Habitat Island, including preliminary design specifications by habitat type, cut-and-fill estimates, and water management. Following review by permitting agencies, the conceptual plans would be further refined to include a water management plan, grading plan, and planting plan.

As discussed in detail in the Conceptual Restoration Plan for Bouldin Island (Exhibit 1 to the draft CMP), the primary actions on the approximately 6,000-acre project area on Bouldin Island consist of converting agricultural fields into forested wetland habitat, and changing crop types to agricultural crops that are more suitable for foraging by Swainson's hawk. Specifically, the following would be created:

- at least 1,464 acres of farmed wetlands, 639 acres forested wetlands, and 116 acres of permanent ponds;
- over 1,024 acres of upland habitat for giant garter snake; and
- over 1,464 acres of upland foraging habitat and 400 acres of nesting habitat for Swainson's hawk.

As discussed in detail in the Conceptual Restoration Plan for Holland Tract (Exhibit 2 to the draft CMP), the primary actions on the 3,007-acre project area on Holland Tract consist of converting agricultural farmlands into aquatic and upland habitat for use by giant garter snake and for Swainson's hawk foraging. Specifically, the following would be created:

- 1,032.8 acres of freshwater marsh, 532.9 acres of seasonal wetlands, 65.0 acres or 61,719 linear feet of canals/ditches and 70.4 acres of permanent ponds;

- a minimum of approximately 1,168 acres of aquatic and approximately 464 acres upland habitat for giant garter snake; and

- approximately 1,324 acres of upland foraging habitat for Swainson's hawk.

Habitat Island Diversions and Discharges

The project would use the existing irrigation water right licenses to supply water for wetlands and wildlife habitat purposes on the Habitat Islands. The timing and volumes of diversions onto the Habitat Islands would depend on the needs of wetlands and wildlife habitat. Wetland diversions typically would begin in September, and water would be circulated through the winter months.

The maximum rate of proposed diversions onto Holland Tract and Bouldin Island would be 200 cfs per island. Water likely would be applied to the Habitat Islands in most months for management of open water and perennial wetlands, flooded seasonal wetlands, and irrigated croplands. Approximately 20 taf would be diverted annually onto the Habitat Islands, which is less than the current agricultural diversions of about 30 taf.

Water would be discharged from the Habitat Islands based on wetland and wildlife management needs. Typically, water would be drawn down by May and the Habitat Islands would remain dry until September, except for permanent water areas and other areas kept wet because of vegetation needs. Existing pumps would be used for discharges and for water circulation on the Habitat Islands. The maximum rate of proposed discharges from Holland Tract and Bouldin Island would be 200 cfs per island.

Levee Improvements and Operations and Maintenance

On the Habitat Islands, the existing levee system would be improved to meet the standards set forth in PL 84-99 . Routine maintenance activities on Habitat Island perimeter levees would not differ from current practices and would include replenishing riprap, placing fill material, placing gravel, reshaping fill material, grading, disking, mowing, selectively burning, controlling rodents, and installing rock revetment. Interior slopes of perimeter levees on the Habitat Islands would be planted to resist erosion from rainfall and maintained according to current practices. Each island's Reclamation District would remain responsible for levee operation and maintenance for flood control after development of the project.

Operation and maintenance activities for the Habitat Islands would include:

- operation and routine maintenance of the existing siphon and pump units;
- management of habitat areas, including, but not limited to, the control of undesirable plant species, agricultural plantings and irrigation, and the maintenance or modification of inner levees, circulation ditches, canals, open water, and water control structures to facilitate flooding and drainage;
- maintenance and monitoring of fish screens during water diversions for habitat maintenance;
- wildlife and habitat monitoring for the CMP;
- inspections and maintenance of perimeter levees; and
- use of the Bouldin Island airstrip for seed dispersal and application of herbicides and other pesticides.

Recreation Facilities

The project has been changed and no longer includes the construction of any new recreational facilities on the Habitat Islands.

CONSTRUCTION SCHEDULE

The preliminary schedule for Reservoir Island construction consists of approximately 1,000 workdays. Initial grading activities on the interior of the islands would be completed during the May-October work window over a period of 3-5 years. Water side construction activities would be completed during the July-October work window over a period of 1-2 years. This timeframe includes project mobilization and staging preparation, project construction, and project cleanup activities. Access is planned via existing roadways and barges. Existing roads would be used for construction access routes and construction staging areas would be established on previously disturbed/developed areas within the interior of the Reservoir Islands.

Construction on the Habitat Islands would occur simultaneously with construction on the Reservoir Islands, and would be completed prior to operation of the Reservoir Islands. Construction access, work windows, and methods for the Habitat Islands would be the same as described for the Reservoir Islands.

2.3.4 ALTERNATIVE 3

Under Alternative 3, all four of the project islands would be used as reservoirs with limited compensation habitat provided on a portion of Bouldin Island. Therefore, the Bouldin Island airstrip would not be maintained under Alternative 3.

Alternative 3 would include the area on Holland Tract that is excluded from the project area under Alternatives 1 and 2 but would not preclude operation of the existing marinas located on the channel side of Holland Tract's southern perimeter levee. Landowners of the Holland Tract area that is not currently owned by Delta Wetlands Properties have been previously contacted, and the project applicant would be required to purchase that area if Alternative 3 were implemented.

Bacon Island, Webb Tract, Bouldin Island, and Holland Tract would all be managed as Reservoir Islands for water diversion, storage, and discharge under Alternative 3. Facilities needed for project operations consist of intake siphon stations with fish screens and auxiliary pumps to divert water onto the island, pump stations to discharge stored water from the islands, improvements to the existing levees, and construction of a new dam, as discussed below.

RESERVOIR ISLANDS

The four Reservoir Islands under Alternative 3 would be designed for water storage levels up to a maximum pool elevation of up to +6 feet relative to mean sea level (NGVD), with a total initial capacity of 406 taf allocated among the islands as follows: Bacon Island, 117 taf; Webb Tract, 119 taf; Bouldin Island, 98 taf; and Holland Tract, 72 taf.

Diversion Facilities

Diversion rates of water onto the Reservoir Islands would vary with pool elevation and water availability. The maximum daily diversion onto either Webb Tract or Bacon Island would be approximately 4,500 cfs (9 taf/day) and onto either Bouldin Island or Holland Tract would be 3,000 cfs (6 taf/day) at the time diversions begin. If water were being diverted to multiple Reservoir Islands at the same time, the combined maximum daily average diversion rate of the islands would not exceed 9,000 cfs. The diversion rate would be reduced as the reservoirs fill, and booster pumps would be used to complete the filling process. The maximum monthly average diversion rate would be approximately 6,000 cfs, which would fill the four reservoir islands in one month.

The siphon designs for all four Reservoir Islands under Alternative 3 would be the same as those described for the two Reservoir Islands (Bacon Island and Webb Tract) under Alternatives 1 and 2. However, more facilities would be constructed under Alternative 3. Two new intake siphon stations would be constructed on each of the four Reservoir Islands, with 16 new siphons each on Bacon Island and Webb Tract and 12 new siphons each on Bouldin Island and Holland Tract, for a total of 112 new siphons. Locations of the proposed siphon stations on Bacon Island and Webb Tract would be the same as those described above for Alternative 2 and shown in

Exhibits 2-1 and 2-2. Proposed siphon stations that would be constructed on Bouldin Island and Holland Tract under Alternative 3 are shown in Exhibits 2-11 and 2-12, respectively.

Discharge Facilities

Discharge pumping would occur at a maximum rate of 4,000 cfs each from Bacon Island and Webb Tract and 2,000 cfs each from Bouldin Island and Holland Tract. The discharge rate for Bacon Island and Webb Tract would be greater than the rate for the other two islands to allow rapid discharge. The maximum combined monthly average discharge rate of the four Reservoir Islands, however, would depend on available export capacity but would be less than 6,000 cfs because the four Reservoir Islands could be emptied in one month at this rate.

The pump station designs for all four Reservoir Islands under Alternative 3 would be the same as those described for the two Reservoir Islands (Bacon Island and Webb Tract) under Alternatives 1 and 2. However, more facilities would be constructed under Alternative 3. One discharge pump station would be installed on each of the four Reservoir Islands, with 40 new pumps at both the Bacon Island and Webb Tract stations and 30 new pumps at both the Bouldin Island and Holland Tract stations, for a total of 140 new pumps. Locations of the proposed pump stations on Bacon Island and Webb Tract would be the same as those described above for Alternative 2 and shown in Exhibits 2-1 and 2-2. Proposed pump stations that would be constructed on Bouldin Island and Holland Tract under Alternative 3 are shown in Exhibits 2-11 and 2-12, respectively.

Levee Improvements and Operations and Maintenance

The perimeter levees of all four Reservoir Islands under Alternative 3 would be buttressed and improved as described in detail for the Reservoir Islands (Bacon Island and Webb Tract) under Alternatives 1 and 2 above. All project levees would be designed to meet or exceed PL 84-99 levee geometry standards at the time of construction. Levee design would control wave erosion through placement of rock revetment on the inside slopes of the perimeter levees. Project-related seepage would be controlled with a slurry wall and an extensive monitoring and shallow groundwater pumping system. During project operation, the perimeter levees would be inspected weekly to identify any erosion, cracking, or seepage problems. Ongoing maintenance activities on the levees would include periodic placement of fill material, placement, or installation of erosion protection material, reshaping or grading of fill material, vegetation control, and regrading or repairing the levee road surface. Each island’s Reclamation District would remain responsible for levee operation and maintenance for flood control after development of the project.

Operation and maintenance activities for the four Reservoir Islands would include the following:

- operation of on-site siphons and pumps during water diversions and discharges;
- inspections and maintenance of perimeter levees, including placement of fill and rock revetment as needed;
- maintenance of inner levees for management of reservoir bottoms;
- maintenance and monitoring of siphon units and fish screens; and
- inspections and maintenance of pump and siphon stations.

Wilkerson Dam

Alternative 3 would require construction of a large interior levee, that would be known as Wilkerson Dam, across Bouldin Island along the south side of SR 12 (see Exhibit 2-5). The dam would provide flood protection to SR 12 and the remainder of Bouldin Island from water stored in the reservoir. Because the dam would retain more than 6 feet of water, its design and construction would be performed under the review and approval of DWR's Division of Safety of Dams (DSOD). Extensive geotechnical studies have been conducted for the levee south of SR 12, and results of the studies and design criteria were developed and submitted to DSOD for review in 1992 (ICF 1995:Appendix E1). The plans for construction of Wilkerson Dam have not changed since that time, and are described below.

Wilkerson Dam would be constructed parallel to SR 12 for most of its length and would abut existing flood control levees on the east and west sides of the island. A typical cross section of the dam embankment is shown in Exhibit 2-13. The dam would be set back from the SR 12 right-of-way to ensure that levee settlement during and after construction would not affect roadbed stability or the feasibility of eventual SR 12 expansion. The setback distance may range from 240 to 370 feet. Erosion protection material such as riprap, a high-density polyethylene (HDPE) liner, or soil cement, would be used on the reservoir side of the dam. Based on the results of geotechnical investigations, the foundation material for most of the length of the dam consists of weak, compressible peat and soft clay; therefore, a wide, flat dam would be constructed in stages over 2-3 years to compensate for settlement of foundation material during construction. To reduce the potential for cracking caused by placement of fill against the existing perimeter levees, embankment slopes would be flattened to 25:1 within 500 feet of abutments. (Harding Lawson Associates 1993 cited in ICF 1995:Appendix E1.)

Settlement of fill is expected during and after construction of Wilkerson Dam. The dam would be constructed in stages with the wide stability berm placed first. As foundation material consolidates and strengthens, additional fill can be placed to raise the center section of the dam. The east end of the proposed alignment would be constructed in two stages; the west end would require three stages of construction. Greater settlement is expected in the west end because the underlying sediments are characterized by thick deposits of compressible peat and soft silt. Subsurface sediments in the east end include peaty silt and stiff silt and therefore are expected to experience less settlement. Slope inclinometers, settlement plates, and piezometers would be installed to provide information on settlement and deformation during and after the construction phase of Wilkerson Dam. Most settlement is expected to occur within 3-5 years after construction. The design criteria for Wilkerson Dam incorporated seismic stability parameters based on regional geology, regional seismicity, and site conditions. A monitoring and maintenance program would be presented with final design specifications for the dam. Maintenance activities may include periodically regrading and raising the dam crest to accommodate settlement. (Harding Lawson Associates 1992 and 1993 cited in ICF 1995:Appendix E1.)

The dam would be constructed primarily with locally available materials, such as sands and silts excavated from borrow sites within the planned reservoir areas south of SR 12. Approximately 8. 9 million cubic yards of sand would be required for dam construction. Borrow material would be moved hydraulically or with earthmoving equipment and compacted to required densities to provide stable fill. Imported materials would likely include graded filter and drainage materials for an internal drain and quarry stone or cement to create either a riprap or soil cement erosion protection for the reservoir side of the dam.

Levee cracks caused by differential settlement of fill after construction and increased hydraulic head from water storage may increase seepage through the dam. Existing seepage drainage ditches are located just outside the SR 12 right-of-way on the north and south sides. The existing ditch on the north side of SR 12 ends approximately 0.75 mile from the east end of Bouldin Island; the project would extend this ditch to the east end of the island as part of project construction. Because increased seepage rates combined with stormwater runoff could cause the drainage ditch to overflow, the drainage ditch would be designed and possibly enlarged to handle the increased flow. However, constructing the dam along SR 12 would greatly reduce the area of the watershed that drains into the ditch during storms, thereby reducing the risk of local flooding.

Groundwater levels beneath the SR l 2 roadbed and in the seepage drainage ditches on both sides of SR 12 are controlled by farming practices. Water levels in the ditches vary by as much as 6 feet over the course of a year because of cyclical flooding and irrigation. Water from the existing drainage ditches would be pumped to stabilize groundwater levels in the ditches and beneath the SR 12 roadbed. To ensure that the project does not cause a substantial increase in water levels, the project would coordinate with the California Department of Transportation (Caltrans) to establish a seepage performance level for Wilkerson Dam. Groundwater levels along SR 12 would be regulated by pumps that maintain water levels in the drainage ditch along SR 12. The pumps would be set to activate automatically if ditch water levels exceed the performance standard established by the project and Caltrans. Use of the pumps to control groundwater levels to the agreed-upon threshold would avoid the need for installation of piezometers along SR 12 to monitor groundwater fluctuations, and would maintain the desired water levels in the drainage ditches.

An internal drainage system and HDPE liner (to reduce and direct seepage) and a cutoff trench (an excavation in the dam filled with material of low permeability that substantially reduces water flowing through the dam) would be used to control seepage through Wilkerson Dam. An internal drainage system schematic is shown in Exhibit 2-13. This system would include pumping facilities to collect seepage from the drainage ditch at the levee toe next to SR 12 and pump it back into the reservoir or into the adjacent slough. Alternatively, extending the HDPE liner to cut off seepage rather than reduce flow rates would reduce the volume of seepage through the dam, thereby resulting in a less extensive pumping system. Final design specifications would be included in the final plans submitted to DSOD for approval. Seepage through Wilkerson Dam also may be reduced through installation of a 3-foot-wide cutoff trench extending vertically from the dam crest into foundation soils. The small amount of water seeping after installation of a cutoff trench could be collected in a shallow toe drain. (Harding Lawson Associates 1992 and 1993 cited in ICF 1995:Appendix E1.)

North Bouldin Habitat Area

Under Alternative 3, a habitat reserve (the North Bouldin Habitat Area [NBHA]) consisting of approximately 875 acres would be created north of SR 12 on Bouldin Island to compensate for some of the impacts associated with water storage operations (see Exhibit 2-11). The ground within the NBHA would be dredged and reshaped to provide year-round and seasonal water for habitat management. The NBHA would be bounded by Wilkerson Dam north of SR 12 and by the island's perimeter levees. A new pump would be constructed in the NBHA for water discharges, and fish screens would be installed on existing siphons for water diversions. The following habitat types and approximate acreages are proposed for the NBHA:

- corn (170 acres)
- perennial pond (50 acres)
- riparian woodland (200 acres)
- seasonal managed wetland (313 acres)
- ditch (17 acres)
- annual grassland (29 acres)
- fallow levee slope (96 acres)

Additional off-site wildlife habitat and wetland compensation would be required for this alternative. Alternative 3 would be inconsistent with the FOC and BOs previously issued for the project.

Recreational Facilities

The project has been changed and no longer includes the construction of any new recreational facilities on the project islands.

2.3.5 ALTERNATIVES CONSIDERED BUT REJECTED

The applicant has prepared an alternatives analysis that considers a range of alternatives per the requirements of the Section 404(b)(1) guidelines (see Appendix J). Each of the alternatives assessed in the 1995 Section 404(b)(1) analysis was updated and reassessed in Appendix J. The alternatives that were considered consisted of nonstructural, off-site, and on-site alternatives, as listed below.

NONSTRUCTURAL ALTERNATIVES

- No-Project Alternative
- Reoperation of the CVP and the SWP

- Water Conservation Alternative
- Water Transfers Alternative

OFF-SITE STRUCTURAL ALTERNATIVES

- Non-Delta Water Storage or Conjunctive Use
- Sierra Supply Sources
- Groundwater Management
- Desalination
- Other Reservoir Sites
- Water Storage on Other Delta Islands

ON-SITE STRUCTURAL ALTERNATIVES

- Alternative 1
- Alternative 2
- Alternative 3

Of the 13 alternatives considered, three of the four nonstructural alternatives as well as five of the off-site structural alternatives were eliminated from further consideration primarily because they are generally unavailable or financially infeasible for the project applicant, and because they likely would not meet the project purpose and need. In contrast, the in-Delta alternatives have access to high-quality water and existing distribution, and therefore could meet the project purpose and need. Water storage could potentially be implemented on Delta islands other than Bacon and Bouldin Islands and Holland and Webb Tracts with facilities and operations equivalent to Alternatives 1 and 2 described above. The other Delta islands that were considered consisted of: Bradford Island, Brannan-Andrus Island, Coney Island, Empire Tract, Jersey Island, Lower Jones Tract, Upper Jones Tract, King Island, Little Mandeville Island, Mandeville Island, McDonald Island, Medford Island, Mildred Island, Orwood Island, Palm Tract, Quimbly Island, Rindge Tract, Lower Roberts Island, Staten Island, Twitchell Island, Venice Island, Victoria Island, and Woodward Island. However, these Delta islands were eliminated from further evaluation as practicable alternatives due to unwilling sellers, technical constraints associated with multiple owners or existing facilities, financial constraints (e.g. relocation or protection of existing facilities and utilities reducing the available storage capacity and rate of return), because their potential as a site for water storage was low, or because the environmental impacts of constructing and operating these sites would be similar to or greater than the four project islands evaluated in Alternatives 1, 2, and 3.

A comprehensive alternatives analysis was completed and used in support of the 2001 FEIS for the previously approved permit application and is included in Appendix J to this SEIS. The Sacramento Superior Court upheld the range of alternatives considered (Alternatives 1, 2, 3 and the No-Project Alternative) in the 2001 FEIR, which were the same alternatives evaluated in the 2001 FEIS and are the same alternatives evaluated in this SEIS, and held that out-of-Delta reservoir alternatives were not required to be considered (*Central Delta Water Agency v. State Water Resources Control Board* (2002) Sacramento County Superior Court Case No. 01CS00345). The trial court held that “[i]n light of the unique operational flexibility offered by this project due to its location, respondent did not abuse its discretion in failing to further consider out-of-Delta alternatives.” The trial court’s conclusion was upheld on appeal in *Central Delta Water Agency v. State Water Resources Control Board* (2004) 124 Cal.App. 4th 245.

Based on the analysis conducted in Appendix J, all of the nonstructural and off-site alternatives (except the No-Action Alternative) were considered but rejected from further analysis in this SEIS. Please see Appendix J for details on each of the above alternatives. The three on-site alternatives and the No-Action Alternative were carried forward for further evaluation in this SEIS.

2.3.6 CHANGES TO THE PROJECT ALTERNATIVES SINCE THE 2001 FEIS

DESIGNATED PLACES OF USE

Original applications filed in 1987 and updated applications and petitions to change the original applications filed in 1993 by the project applicant identified the entire SWP and CVP service areas and the Bay-Delta estuary as the place of use for project water. Potential users of project water were assumed to be any user within this broad place of use. Potential beneficial uses for project water included irrigation, municipal and industrial, fish and wildlife enhancement, and water quality for the Bay-Delta estuary. As discussed in Chapter 1, "Introduction," the Third District Court of Appeal in *Central Delta Water Agency v. State Water Resources Control Board*, 124 Cal. App. 4th 245 (2004) required that designated places of use be more specifically identified.

The specific places of use for project water consist of Semitropic, Metropolitan, Western, and Golden State as discussed in in detail below. These places of use require additional sources of water to improve the reliability of their existing water supplies to meet current demand, and have infrastructure in place for conveyance and transfer of project water. The project water would be used to improve water supply reliability for their current water uses, which include irrigation, domestic, and municipal and industrial beneficial uses. Table 2-1 defines the annual demands and estimated maximum annual deliveries of project water for each place of use.

Table 2-1
Overview of Place of Use Demands and Project Deliveries

Place of Use	Estimated Total Annual Demand (taf)	Population	Agricultural Acreage/ Annual Demand	Estimated Maximum Annual Delivery from Project (taf)[1]
Semitropic Water Storage District in Kern County	420	Ag. only	140,000 acres/ 420 taf	45
Metropolitan Water District of Southern California[2]	2,100	19,000,000	135 taf	223
Golden State Water Company	240	1,000,000	Not available	20
Total	**2,760**	**20,000,000**	**>140,000 acres/ >555 taf**	**280**

Notes: taf = thousand acre-feet

[1] Denotes estimates of the maximum annual deliveries of project water to each place of use, and not average deliveries. The sum of the estimated maximum annual deliveries exceeds anticipated project yield.

[2] Metropolitan Water District of Southern California includes Western Municipal Water District of Riverside County.

Sources: ICF 2010:2-3 and Environmental Science Associates 2011:2-6

The project water would be delivered to these south-of-Delta users via existing and previously approved facilities operated and maintained by the SWP and CVP (and/or contractors) and those within the proposed places of use (designated water districts). No new, expanded, or modified facilities would be required to convey the project water to the designated places of use.

As described and evaluated in the 2000 RDEIR/EIS, 2001 FEIR, and 2001 FEIS, the project water also may be released to benefit outflow, water quality, and fish and wildlife resources in the Bay-Delta estuary.

Semitropic Water Storage District

Water exported to Semitropic from the project would augment Semitropic's overlying groundwater and SWP water supplies. Semitropic is a public water agency located in Kern County and provides water to irrigate approximately 140,000 acres for agricultural uses. Established in 1958, Semitropic began as an irrigation district for the purpose of securing SWP supplies to reduce groundwater overdraft. The full water supply needs of Semitropic are approximately 420,000 acre-feet per year (af/yr) (i.e., about 3 feet of applied water). The project would support Semitropic's objectives to increase water supply reliability, reduce groundwater overdraft, raise groundwater levels and reduce pump lift, and maximize the use of its estimated 1.65 million acre-feet (maf) of groundwater storage. The Semitropic places of use are shown in Exhibits 1-2 and 1-3 in Chapter 1, "Introduction."

As discussed in Chapter 1, "Introduction," additional information about Semitropic's operations is covered under the *Semitropic Groundwater Banking Project Final EIR* (State Clearinghouse [SCH]#1993072024), and the *Semitropic Groundwater Banking Project Stored Water Recovery Unit Final Supplemental EIR* (SCH#1999031100) (Navigant Consulting and Bookman-Edmonston Engineering 2000).

Metropolitan Water District of Southern California

Metropolitan is a wholesale water agency supplying water to 19 million consumers through 26 member public agencies. Metropolitan's two primary sources of supply are the Colorado River and the SWP. The percentage of supplies from these sources varies from year to year. The Colorado River Aqueduct has a maximum annual delivery capacity of approximately 1.2 maf. The Metropolitan contract for SWP water calls for a maximum of approximately 1.9 maf, but maximum annual SWP delivery so far has been approximately 1.5 maf. Metropolitan supplies about two-thirds of the total water deliveries made by its member agencies.

Water exported to Metropolitan would help augment the agricultural, industrial, and municipal water supply distributed within the 5,200 square miles serviced by Metropolitan. Encompassing Los Angeles, Orange, San Diego, Riverside, San Bernardino, and Ventura Counties, Metropolitan includes a population of approximately 18 million customers served through the state-chartered cooperative's 26 member agencies. Metropolitan's member agencies are identified in Table 2-2, and include Western Municipal Water District of Riverside County, discussed separately below. The project water deliveries would support Metropolitan's objectives of increasing municipal and industrial water supply reliability in the face of past and anticipated future supply shortages.

Project water provided to Metropolitan would improve the reliability of Metropolitan's existing supplies that have been reduced due to regulatory and climactic factors. The project water would be blended with Metropolitan's existing supplies and distributed across the Metropolitan service area. Project water may also be provided to specific Metropolitan member agencies that contract with the project. Additional information about Metropolitan's service area, operations, use, deliveries, and planning objectives can be found in its *Regional Urban Water Management Plan*, dated November 2005.

Western Municipal Water District of Riverside County

Western, a Metropolitan member agency, was formed in 1954. It provides supplemental water to the cities of Corona, Norco, and Riverside and the water agencies of Box Springs Mutual, Eagle Valley Mutual, Elsinore Valley, Lee Lake, and Rancho California. Western serves customers in the unincorporated areas of El Sobrante, Eagle Valley, Temescal Creek, Woodcrest, Lake Mathews, and March Air Reserve Base. Western's general district consists of a 527-square-mile area of western Riverside County, with a population of approximately 853,000 people. Western currently sells approximately 125,000 af of water annually, obtained from the Colorado River, State Water project and groundwater pumping. Additional information about Western's service area, operations, use, deliveries, and planning objectives can be found in Metropolitan's *Regional Urban Water Management Plan*, dated November 2005.

Table 2-2
Metropolitan Water District of Southern California Member Agencies and Cities

Municipal Water Districts		Member Cities			County Water Authorities
Calleguas	Orange County	Anaheim	Glendale	San Marino	San Diego
Central Basin	Three Valleys	Beverly Hills	Long Beach	Santa Ana	
Foothill	Upper San Gabriel Valley	Burbank	Los Angeles	Santa Monica	
Inland Empire	West Basin	Compton	Pasadena	Torrance	
Eastern	Western	Fullerton	San Fernando		
Las Virgenes					

Calleguas MWD
Camarillo
Camarillo Heights*
Fairview*
Las Posas Valley*
Moorpark
Oak Park*
Oxnard
Port Hueneme (annexed)*
Santa Rosa Valley*
Simi Valley
Thousand Oaks

Central Basin MWD
Artesia
Bell
Bellflower
Cerritos
Commerce
Cudahy
Downey
East Compton*
East La Mirada*
East Los Angeles*
Florence*
Graham*
Hawaiian Gardens
Huntington Gardens*
La Habra Heights
Lakewood
Los Nietos*
La Mirada
Lynwood
Maywood
Montebello
Norwalk
Paramount

Eastern MWD
East Hemet*
Good Hope*
Hemet
Homeland*
Lakeview-Nuevo*
Mead Valley*
Moreno Valley
Murrieta Hot Springs*
Perris
Quail Valley*
Romoland*
San Jacinto
Sun City*
Sunnymead*
Temecula
Valle Vista*
Winchester*

Las Virgenes MWD
Agoura Hills
Calabasas
Chatsworth Lake Manor*
Hidden Hills
Malibu Lake*
Monte Nido*
Westlake Village

MWD of Orange County
Aliso Viejo
Brea
Buena Park
Capistrano Beach*
Corona del Mar
Costa Mesa
Cypress
Dana Point
El Toro*

Three Valleys MWD
Charter Oak*
Claremont
Covina Knolls*
Diamond Bar
Glendora
Industry
La Verne
Pomona
Rowland Heights*
San Dimas
South San Jose Hills*
Walnut

Upper San Gabriel Valley MWD
Arcadia
Avocado Heights*
Azusa
Baldwin Park
Bradbury
Citrus*
Covina
Duarte
El Monte
Hacienda Heights*
Irwindale
La Puente
Mayflower Village*
Monrovia
Rosemead
San Gabriel*
South El Monte
South Pasadena
South San Gabriel
Temple City
Valinda*

West Basin MWD (cont'd)
Ross Sexton*
Topanga Canyon*
Victor*
View Park*
West Athens*
West Carson*
West Hollywood
Westmost*
Windsor Hills*
National Military Home*
Wiseburn*
Windsor Hills*
National Military Home*
Wiseburn*

Western MWD of Riverside County
Bedford Heights*
Corona
Eagle Valley*
El Sobrante*
Green River*
Lake Elsinore
March Air Force Base*
Murrieta
Norco
Riverside
Temescal
Woodcrest*

San Diego CWA
Alpine*
Bonita*
Camp Pendleton*
Carlsbad
Casa De Oro*
Castle Park*

Table 2-2 Metropolitan Water District of Southern California Member Agencies and Cities			
Pico Rivera	Fountain Valley	West Covina	Chula Vista
Santa Fe Springs	Garden Grove	West Puente Village*	Del Mar
Signal Hill	Huntington Beach	**West Basin MWD**	El Cajon
South Gate	Irvine	Alondra Park*	Encinitas
South Whittier*	Lake Forest	Angeles Mesa*	Escondido
Vernon	Laguna Beach	Carson	Fallbrook*
Walnut Park*	Laguna Hills	Culver City	Lakeside*
West Compton*	Laguna Niguel	Del Aire*	La Mesa
West Whittier*	Laguna Woods	El Nido–Clifton*	Lemon Grove
Whittier	La Habra	El Segundo	Mount Helix*
Willowbrook*	La Palma	Gardena	National City
Foothill MWD	Los Alamitos	Hawthorne	Oceanside
Altadena*	Mission Viejo	Inglewood	Otay*
La Canada	Newport Beach	Ladera Heights*	Poway
La Crescenta*	Orange	Lawndale	Rainbow*
Mintridge	Placentia	Lennox*	Ramona*
Montrose*	Rossmoor*	Lomita	Rancho Santa Fe*
Inland Empire	San Clemente	Malibu	San Diego
Chino	San Juan Capistrano	Manhattan Beach	San Marcos
Chino Hills	Seal Beach	Marina del Rey*	Santee
Fontana	South Laguna*	Palos Verdes Estates	Solana Beach
Montclair	Stanton	Point Dume*	Spring Valley*
Ontario	Tustin	Rancho Palos Verdes	Valley Center*
Rancho Cucamonga	Tustin Foothills*	Redondo Beach	Vista
Upland	Villa Park	Rolling Hills	
	Westminster	Rolling Hills Estates	
	Yorba Linda		

Note: * = unincorporated areas; MWD = Metropolitan Water District

Source: ICF 2010:6-2; adapted by AECOM in 2013

Golden State Water Company

Water exported to Golden State from the project would increase the reliability of existing municipal and industrial deliveries for areas currently served. Golden State is a private water company that provides water service to more than 255,000 customers located within 75 communities throughout 10 counties in northern, coastal, and southern California. Golden State delivers approximately 42 taf throughout its service area, based on a conservative (low) assumed customer use of 150 gallons per day (gal/day). The project water would be supplied to Golden State users in 33 water systems and 53 communities in coastal and southern California in portions of Los Angeles, Orange, San Bernardino, San Luis Obispo, Santa Barbara, and Ventura Counties as shown in Exhibits 1-4a through 1-4g (in Chapter 1, "Introduction") and listed in Table 2-3.

able 2-3
Golden State Water Agency Systems and Communities for Project Water

Systems				
Region 1	Region 2		Region 3	
Edna	Artesia		Apple Valley North	Morongo
Los Osos	Bell/Bell Gardens		Apple Valley South	Placentia
Lake Marie	Culver City		Barstow	San Dimas
Nipomo	Florence Graham		Calipatria	South Arcadia
Ojai	Hollydale		Claremont	South San Gabriel
Orcutt	Norwalk		Cowan Heights	West Orange County
Simi Valley	Southwest		Desert View	Wrightwood
Sisquoc	Willowbrook		Lucerne	Yorba Linda
Tanglewood				
Communities				
Region 1	Region 2		Region 3	
Bay Point	Artesia	Hawaii Gardens	Apple Valley	Lucerne Valley
Clearlake	Athens	Hawthorne	Arcadia	Morongo Valley
Cordova	Bell	Hollydale	Barstow	Pomona
Los Osos	Bell Gardens	Inglewood	Calipatria	Rosemead
Santa Maria	Carson	Lakewood	Claremont	Rossmoor
Orcutt	Cerritos	Lawndale	Covina	San Dimas
Ojai	Compton	Liberty Acres	Cypress	San Gabriel
Simi Valley	Cudahay	Lennox	Duarte	Seal Beach
	Culver City	Norwalk	La Verne	Stanton
	El Camino Village	South Gate	Los Alamitos	Temple City
	Florence	Torrance		
	Gardena	Willowbrook		
	Graham			

Source: ICF 2010: 6-3; adapted by AECOM in 2013

BAY-DELTA ESTUARY RELEASES

Project water may be released to benefit outflow, water quality, and fish and wildlife resources in the Bay–Delta Estuary. Water supply modeling (see Section 2.3, “Water Project Operations”) describes how project water would be used to supplement Delta outflow in the fall season of years when there is no capacity to export project water during the water supply (or groundwater banking) discharge period of July–November. These releases would benefit all CVP and SWP contractors by reducing the salinity of the exports during these periods of low Delta outflow.

GROUNDWATER BANKS

Project water not needed for designated place of use demands in a year with relatively high deliveries may be stored in the Semitropic Groundwater Storage Bank and/or the Antelope Valley Water Bank for later delivery to the designated places of use. Project water would be conveyed to the Semitropic Groundwater Storage Bank or Antelope Valley Water Bank using existing SWP and CVP and local water conveyance facilities. No new construction would be required to convey project water to the groundwater banks for recharge (infiltration) or for pumping and delivery from the groundwater banks.

This integration with these approved and operational groundwater banks would allow project water to be available in subsequent years to meet water supply needs for the designated places of use, and contribute to the California

Water Plan objectives for regional conjunctive (i.e., integrated groundwater and surface supply) water management. The project water that is delivered to these groundwater recharge and storage facilities would be stored twice prior to delivery to the designated places of use:

- first, project water would be stored seasonally on the project Reservoir Islands from the time of diversion during high Delta inflow periods until the summer or fall when the project water is discharged for export; and

- second, project water would be stored for a year or more in the groundwater bank facilities and then pumped to the overlying places of use or to the other designated places of use to meet water supply needs in a relatively dry year.

Semitropic Groundwater Storage Bank

The Semitropic Groundwater Storage Bank has been operating since the early 1990s. Project water banked in the Semitropic Groundwater Storage Bank would employ pipelines currently being used for agricultural irrigation. Semitropic has a recharge capacity of 140,000 af/yr and a pumping capacity of 290,000 af/yr. Semitropic Groundwater Storage Bank operates through cooperative agreements with six banking partners who have delivered approximately 700,000 af of surplus water to Semitropic. Whenever necessary, Semitropic returns the stored water to the California Aqueduct (part of the SWP) for use by its partners by either entitlement exchange or pumpback, with a maximum pumpback capacity into the California Aqueduct of 90,000 af/yr. Current Semitropic Groundwater Storage Bank project storage capabilities are 1.65 maf.

As discussed in Chapter 1, "Introduction" and referenced previously in this chapter, additional information about Semitropic's operations is covered under the *Semitropic Groundwater Banking Project Final EIR* (SCH#1993072024), and the *Semitropic Groundwater Banking project Stored Water Recovery Unit Final Supplemental EIR* (SCH#1999031100) (Navigant Consulting and Bookman-Edmonston Engineering 2000).

Antelope Valley Water Bank

The Antelope Valley Water Bank is being developed by a Joint Powers Authority comprised of Semitropic, Rosamond Community Services District, and Valley Mutual Water Company.

Construction and operation of the Antelope Valley Water Bank recharge and pumping facilities have been approved and the project is under construction. In Phase 1 of the Antelope Valley Water Bank, a new 4-mile-long pipeline would be constructed to distribute water between the Antelope Valley–East Kern Water Agency (AVEK) West Feeder and the associated recharge and recovery facilities. In Phase 2, a new 8.75-mile-long pipeline would be constructed between the California Aqueduct East Branch and the recharge and recovery facilities. The Antelope Valley Water Bank has a turnout from the AVEK West Feeder and piping that feeds a series of recharge basins.

Project water banked in the Antelope Valley Water Bank would use existing agricultural irrigation pipelines and proposed new pipelines that are fully approved for construction, have independent utility, and are not part of the Proposed Action. Water would be delivered to the recharge basins via the East Branch of the California Aqueduct, the AVEK West Feeder, and the distribution/recovery pipeline installed from the Van Dam Turnout to the northwest corner of the recharge basin area. Three earthen canals extending southward from the distribution pipeline would deliver water to the recharge basins. The Antelope Valley Water Bank is designed to receive water at a rate of up to 350 cfs and to recharge up to 100,000 af/yr. Surface water recharged into the basins would percolate through the subsurface for storage into dewatered portions of the underlying aquifer. The total storage capacity of the Antelope Valley Water Bank is estimated at 500,000 af.

As discussed in Chapter 1, "Introduction," additional information about the Antelope Valley Water Bank can be found in the *Antelope Valley Water Bank Final EIR* (SCH#2005091117) (Kern County Planning Department 2006).

REMOVAL OF PROPOSED RECREATIONAL FACILITIES

The project originally proposed the construction of up to 11 recreational facilities on each Reservoir Island, up to 10 new recreation facilities on Bouldin Island, and up to six new recreation facilities on Holland Tract (for a total of 38 new recreation facilities) on the perimeter levees. The 2001 FEIS and 2010 DEIR both included a mitigation measure that would have removed all 22 facilities proposed for construction from Bacon Island and Webb Tract, and would have reduced the number or size of proposed facilities on Bouldin Island and Holland Tract by 70%. However, since that time, the project applicant has amended its Department of the Army permit application to USACE for wetland fill, and has removed the proposal to construct any new recreational facilities from its permit application. Alternatives 1, 2, and 3 no longer include a proposal to construct any new recreational facilities; therefore, they have been eliminated from the project and action alternatives.

2.3.7 ENVIRONMENTAL COMMITMENTS

Environmental commitments are measures incorporated by the project applicant as part of the project description, meaning they are proposed as elements of the Proposed Action and, like all other elements of the Proposed Action, are to be fully considered and evaluated in conducting the environmental analysis and determining effects and findings. The purpose of environmental commitments are to reflect and incorporate best practices and performance standards into the project that avoid, minimize, or offset potential environmental effects. *Note: The term* mitigation *is specifically applied in this SEIS only to designated measures required to reduce environmental effectsof the project;* environmental commitments *are not considered to be mitigation but part of the project.* These best practices tend to be relatively standardized and compulsory; they represent sound and proven methods to reduce the potentially significant effects of an action. The rationale behind including environmental commitments is that the project applicant commits to undertake and implement these measures, as part of the project in advance of impact findings and determinations, in good faith to improve the quality and integrity of the project, streamline the environmental analysis, and demonstrate responsiveness and sensitivity to environmental protection and quality.

Several changes in project design, mitigation measures from the 1995 DEIR/EIS and the 2000 RDEIR/EIS, and many prior agreements with Delta water rights holders or agencies (such as the FOC to protect fish and the water quality management plan) have been incorporated as project environmental commitments. The environmental commitments are detailed below.

TWO-ISLAND COMPENSATORY MANAGEMENT PLAN

The original project plans as proposed in 1990 consisted of a four-reservoir project. Subsequently, two islands were dedicated to environmental management with wildlife-friendly agriculture and habitat protection and enhancement areas as a condition of the DFW Incidental Take Permit. The CMP, including its implementation, is a major environmental commitment relative to the original proposal. The goal of the CMP is to offset project impacts from the two Reservoir Islands on listed Threatened and Endangered species, wintering waterfowl, and jurisdictional wetlands. Land management practices to benefit other wildlife species also have been incorporated. The CMP planning team (the project applicant, in collaboration with DFW, SWRCB, and others) designed the island habitats and management prescriptions to achieve three goals, listed in order of importance below.

- **Compensation goals**. Compensate for project impacts on species listed as Threatened or Endangered under the Federal Endangered Species Act (ESA) and the California Endangered Species Act (CESA), wintering waterfowl habitat, and jurisdictional wetlands, including riparian habitats. Compensation goals must be achieved to offset project impacts.

- **Species goals**. Without compromising compensation goals, implement land management practices to provide the greatest benefit to upland wildlife species; enhance breeding habitat for waterfowl, roosting habitat for greater sandhill cranes, and nesting habitat for Swainson's hawks; and provide potential habitats for other special-status species. Species goals should be implemented to enhance overall wildlife values associated with compensation habitats.

- **Other important goals**. Implement best land management practices that do not detract from compensation and priority species goals to enhance habitat conditions for other important species or species groups, such as migratory shorebirds, nongame water birds, and species associated with riparian habitats.

The CMP is a major environmental commitment that avoids and reduces many potential impacts on vegetation and wildlife species. Management prescriptions for habitat types and acreages of habitat types to be developed on Holland Tract and Bouldin Island would depend on the preparation of a final CMP that is subject to agency review and approval. The draft CMP is attached to this SDEIS as Appendix B. Additional details of CMP implementation are described in Section 3.5, "Biological Resources."

RESERVOIR ISLAND CONSTRUCTION MONITORING PROGRAM

To avoid construction-related take of Federally and state-listed wildlife species on the Reservoir Islands, a Reservoir Island Construction Monitoring program would be developed. This program would include preconstruction survey protocols and avoidance measures for giant garter snake, Swainson's hawk, greater sandhill crane, California black rail, and other avian species. Additional details regarding the Reservoir Island Construction Monitoring program are described in Section 3.5, "Biological Resources."

SCREENED DIVERSIONS

The diversion siphons/pumps required for the project would be screened for fish protection. Positive barrier screens may not protect larvae and small juvenile fish, but they are very effective in reducing the entrainment loss of larger juvenile and adult migrating fish. The fish screens would meet USFWS criteria for delta smelt (0.2 feet per second [ft/sec] approach velocity) and NMFS criteria for anadromous salmonids, and would consist of a drum design to minimize the length of exposure, drawing water from all directions. Additional information on the type of screens that are likely to be used for the project is available at the following website: <http://www.intakescreensinc.com>.

FISH MONITORING AND HABITAT PROTECTION

Previous fish impact evaluations and the project BOs have suggested or required monitoring and operational criteria for fish protection. These are generally described together here as an environmental commitment. This includes several operations for Webb Tract diversions that were agreed to with the East Bay Municipal Utility District (EBMUD).

Temperature Assessment Program

This environmental commitment is the same as the 1997 FOC except that the temperature measurements are specified to be weekly averages to account for daily variations in temperature. The project will implement a temperature program to minimize or avoid adverse impacts of project discharges, as set forth below:

a) The project will not discharge reservoir water for export if the weekly average temperature differential between the discharge and the adjacent channel temperature is greater than or equal to 20°F.

b) If the natural receiving water temperature of the adjacent channel is greater than or equal to a weekly average of 55°F and less than 66°F, project discharges will not increase the channel temperature by more than a weekly average of 4°F.

c) If the natural receiving water temperature of the adjacent channel is greater than or equal to a weekly average of 66°F and less than 77°F, project discharges for export will not cause an increase of more than a weekly average of 2°F.

d) If the natural receiving water temperature of the adjacent channel is greater than or equal to a weekly average of 77°F, project discharges for export will not cause an increase of more than a weekly average of 1°F.

e) The project will develop temperature monitoring and implementation plans to ensure that the project does not adversely affect the channel temperature levels as described above. The monitoring plan will include reservoir and channel temperature monitoring. The monitoring and implementation plan will be completed after the project is permitted by USFWS, DFW, and NMFS (and will incorporate permit requirements from those agencies), but at least 90 days prior to the start of project operations, and will be submitted to the responsible agencies for approval with the concurrence of USFWS, NMFS, and DFW. Because the monitoring and implementation plans rely on design details that must be approved by USFWS, NMFS and DFW, these plans would not be developed until permits from these agencies are received.

The above criteria are consistent with or are more stringent than the existing Basin Plan for the Delta (Central Valley Regional Water Quality Control Board 2011a):

> "Temperature (page III-8): The maximum temperature of the discharge shall not exceed the natural receiving water temperature by more than 20°F. At no time or place shall the temperature of COLD or WARM intrastate waters be increased more than 5°F above natural receiving water temperature."

Should updated permit conditions from USFWS, NMFS, or DFW include more stringent criteria for temperature, those would be adopted.

Dissolved Oxygen Standards

This environmental commitment is identical to the FOC. The project will implement a dissolved oxygen (DO) monitoring program to avoid and minimize adverse impacts of project discharges for export, as set forth below:

a) The project will not discharge reservoir water for export if the discharge DO level is less than 6.0 mg/l without authorization from the resource agencies and notice to the responsible agencies.

b) The project will not discharge reservoir water for export if the discharge would cause channel water DO levels to fall below 5.0 mg/l.

c) The project will develop DO monitoring and implementation plans to ensure that the project does not adversely affect the channel DO levels as described above. The monitoring plan will include reservoir and channel DO monitoring. The monitoring and implementation plans will be completed after the project is permitted, but at least 90 days prior to the start of project operations, and the plans will be submitted to the responsible agencies for approval with the concurrence of USFWS, NMFS, and DFW.

The above criteria are consistent with or are more stringent than the existing Basin Plan for the Delta (Central Valley Regional Water Quality Control Board 2011a):

> "Dissolved Oxygen (page III-5): Within the legal boundaries of the Delta, the dissolved oxygen concentration shall not be reduced below 5.0 mg/l in all other Delta waters except for those bodies of water which are constructed for special purposes and from which fish have been excluded or where the fishery is not important as a beneficial use."

Should updated permit conditions from USFWS, NMFS, or DFW include more stringent criteria for DO, those would be adopted.

Diversion and Discharge Reductions During Smelt Presence

During January–March, the project will obtain the most recent information on larval and early-juvenile longfin and delta smelt distribution from the DFW larval smelt and 20-mm surveys. The larval smelt survey (initiated in January 2009) begins in the second week of January and runs every second week until the second week in March. The 20-mm survey begins in mid-March and samples a variety of sites fortnightly until mid-July. Presence of larval smelt in the vicinity of the project Reservoir Islands will trigger monitoring of project diversion sites for evidence of larval smelt. Monitoring will be required only for the Reservoir Island(s) near which larval smelt have been collected. The triggers for monitoring of diversion sites are:

- Webb Tract: presence of at least one larval smelt at survey stations 809, 812, 815, or 901;

- Bacon Island: presence of at least one larval smelt at survey stations 902, 914, 915, or 918.

- Diversion sites will be monitored daily during diversion periods. Should larval smelt be detected, the diversion rate will be immediately reduced by 50%. Smelt presence is defined as a 2-day running average in excess of one (1) delta or longfin smelt per day at the sampled reservoir diversion station. If the 2-day running average of smelt presence is below one smelt per day, diversions will be increased by 10% per day to 100% after 5 days. Daily monitoring will continue until the subsequent larval smelt survey's data are available. If these data indicate that larval smelt are no longer present in the vicinity of the Reservoir Island(s) then diversion monitoring will cease. Monitoring will recommence if subsequent DFW smelt larval surveys once again reveal smelt presence at the stations noted above. Monitoring will not be required at a diversion station if the total diversion rate at the station is less than 50 cfs (e.g., during topping-off).

- Weekly monitoring reports will be transmitted by fax and daily reports by email to the fishery agencies as follows:

    - USFWS, Sacramento Fish and Wildlife Office
    - NMFS, Protected Resources and Habitat Conservation Division
    - DFW, Habitat Conservation Division (Central Valley–Bay Delta Branch)

- Monitoring samples (preserved fish) will be retained for a minimum of 1 year after collection. Agency biologists and law enforcement personnel will have 24-hour access to fish monitoring personnel, fish samples, and daily fish capture data. A QA/QC protocol, acceptable to the fishery agencies, will be developed and provided to the fishery agencies as part of the final monitoring program plan. The QA/QC protocol will include, but is not limited to, measures to ensure correct identification of larval and juvenile fishes.

- During July, the project will obtain the most recent information on fish salvage at the SWP and CVP fish facilities. If juvenile longfin or delta smelt are present in salvage collections, the discharge for export rate will immediately be reduced by 50%. Smelt presence is defined as a 2-day running average in excess of one (1) delta or longfin smelt per day at either fish salvage facility. Discharges will be increased to 100% if monitoring data indicate that the 2-day running average of smelt presence is below one smelt per day.

- The project will establish a Monitoring Technical Advisory Committee (MTAC) to advise and resolve monitoring issues that may develop over the life of the project. The MTAC will be made up of voluntary participants from a variety of agencies, including, but not limited to, invitees from SWRCB, USACE, USFWS, NMFS, DFW, DWR, U.S. Bureau of Reclamation (Reclamation), EPA, and the project applicant. The project may convene the MTAC to evaluate and recommend adjustments to the monitoring program.

Initially, the project will work directly with DFW to resolve daily technical monitoring issues but may convene the MTAC to act in a technical capacity to provide review and address any technical inadequacies or disagreements that may occur. The committee also may provide advisory review on issues of waiver occurring during implementation of the monitoring program. Any modifications to the monitoring program must be made with the approval of the responsible agencies and concurrence of the resource agencies who will continue to retain final approval or disapproval of any monitoring changes.

Chipps Island Conservation Easement

The project applicant has agreed to provide a conservation easement on approximately 200 acres of brackish tidal wetlands on the western tip of Chipps Island to compensate for a potential shift in X2 (per a prior agreement with DFW). The applicant is also proposing to conserve in perpetuity an additional 40 acres of brackish tidal wetlands on Chipps Island to compensate for adverse effects related to the loss of shallow water habitat that would result in the construction of docks and pumps at the Reservoir Islands. Therefore, the applicant is proposing to conserve in perpetuity approximately 240 acre of brackish tidal wetlands on Chipps Island, to protect this prime estuarine tidal wetlands habitat from future conversion back to duck club-managed wetlands.

A management plan for the easement area will be developed by the project within the first year of project operation for the habitat covered by the easement,and will be incorporated as an exhibit to the easement.

Additionally, the project applicant will provide documentation to the USFWS demonstrating that there is adequate financing for the perpetual management of the habitat protected by the conservation easement consistent with the management plan including that (1) adequate funds for the management of habitat in perpetuity protected by the conservation easement have been transferred to an appropriate third-party, and (2) the third party has accepted the funds, and (3) such funds have been deposited in an interest-bearing account intended for the sole purpose of carrying out the purposes of this easement.

The easement (along with a title report for the easement area) and management plan will be approved by the USFWS prior to recordation. After approval, the easement and management plan will be recorded in the appropriate County Recorder's Office(s). A copy of the recorded easement will be provided to the USFWS within 30 days after recordation. The above-listed actions will occur prior to any work being performed in the area covered by the easement.

CONSERVATION EASEMENTS ON HABITAT ISLANDS

To ensure continued habitat management and agricultural production on the Habitat Islands, the project applicant would record conservation easements over Bouldin Island and Holland Tract lands controlled by Delta Wetlands Properties. The easements would be developed to be consistent with the CMP and would be recorded in San Joaquin County and Contra Costa County, respectively. The easements would cover all lands within the perimeter levee interiors (see Exhibits 2-3 and 2-4). The proposed CMP is designed to be consistent with the 2008 Mitigation Rule.

PRIOR AGREEMENTS WITH OTHER PARTIES

Water Rights

In response to the 1997 SWRCB water right hearing, 18 parties filed protests with SWRCB against the project applicant's water rights applications. The project entered into negotiations with some of these parties. As a result of these discussions, the project applicant entered into stipulated agreements with Reclamation, DWR, Amador County, City of Stockton, and North Delta Water Agency that affirm the seniority of protesting parties' water rights (Amador and Stockton), or agree to operate the project in a manner that is consistent with the existing CVP and SWP Delta operations and follows the water quality objectives in the Delta that protect existing water users

(Reclamation, DWR, North Delta Water Agency). All protest dismissal agreements are included on each compact disc of the digital version of this SEIS.

Delta Water Supply Accounting Procedures

SWRCB resumed and completed the water right hearing in 2000. During the hearing, the project applicant entered into protest dismissal agreements with California Urban Water Agencies (CUWA), EBMUD, and Contra Costa Water District (CCWD). These agreements include the WQMP, which provides several requirements for daily flow, salinity, and DOC monitoring, as well as modeling and accounting for the contribution of project discharges and releases at the water supply intakes.

The project operations would be tracked with daily water accounting. DWR Division of Operations and Maintenance, in cooperation with Reclamation's Central Valley Operations Center (CVOC), maintains daily water budget estimates for the Delta and designates the Delta condition each day as being "in balance" or "in excess" relative to all SWRCB objectives and water right terms and conditions. When the Delta condition is designated by DWR and Reclamation to be in balance, all Delta inflow is determined to be required to meet Delta objectives and satisfy diversions by CCWD, the CVP, the SWP, other senior water right holders, and Delta riparian water users. Therefore, when the Delta is in balance, additional water would not be available for diversion by the project.

When DWR (and Reclamation) determine the Delta condition to be in excess, the project would be allowed to divert available excess water for storage on the Reservoir Islands. The daily quantity of available excess water would be estimated according to the normal Delta water supply accounting procedures. To provide extra protection for compliance with 1995 WQCP Delta objectives (D-1641) and for existing water right holders, SWRCB may establish requirements for amounts of water within the designated excess water (buffers) that would be available for project diversions. Even with additional SWRCB–established safeguards in place, excess Delta inflow is available for diversion during certain periods, especially major runoff events.

The project would submit timely reports to SWRCB on the daily operations of each Reservoir Island, as well as the daily Delta conditions that may affect project diversions and discharges for export or releases for Delta outflow. These monitoring and reporting requirements are similar to mitigation monitoring required for other water projects. These monitoring and reporting requirements (under the protest dismissal agreements) would provide an accurate record of project operations and water supply and water quality benefits.

Pacific Gas and Electric Company Agreement

The project applicant and the Pacific Gas and Electric Company (PG&E) entered into an agreement in 2006 (Delta Wetlands Properties 2006), amended in 2007, that resolved PG&E's protest to the project water right applications. This agreement has resulted in environmental commitments specific to utilities as follows:

- If levee embankment construction for the project creates stress on the Line 57B pipeline that is significantly greater than the stress on the pipeline caused by the current levee, the project will pay for the design and construction of a mutually acceptable engineering solution to reinforce, replace, or relocate the Line 57B eastern levee crossing on Bacon Island before water is diverted for storage onto Bacon Island.

- Line 57B, at the western Bacon Island levee embankment adjacent to Old River, will be replaced with a new pipeline installed by horizontal directional drillng (HDD) between Bacon Island and Palm Tract, unless the Project and PG&E mutually agree in writing to another approach. The design and length will be similar to the Line 57C HDD crossing, including setbacks to prevent pipe exposure in the event of a levee failure. Prior to construction of the new pipeline, the project and PG&E will enter into a 50/50 cost sharing agreement for the design, permitting, material procurement, and construction of a new Line 57B HDD crossing beneath Old River, Bacon Island, and Palm Tract levees. The project's construction activities that require the isolation and blowdown of Line 57B will occur only at a time when activities will not disrupt PG&E gas operations, typically between April 15 and November 15.

- The project will pay to relocate the Line 57B cathodic protection station on Bacon Island, and will provide facilities for PG&E's annual inspection of pipelines 57B and 57C before water is diverted for storage onto Bacon Island.

- The project will compensate PG&E for any loss or damage to Line 57C caused by the conversion of Bacon Island into a water storage reservoir.

In addition to the above commitments stipulated in the settlement agreement, during levee strengthening, project engineers will install equipment to monitor levee settlement and subsidence rates. After levee completion, the project will conduct weekly inspections to check for potential problems at the gas pipeline crossings, including concerns about levee stability, settlement, and subsidence. If the weekly inspection indicates that settlement, erosion, or slumping at the gas pipelines has occurred, the project will notify PG&E and will implement corrective measures to mitigate any decrease in levee stability near the gas lines.

East Bay Municipal Utility District Agreement

The stipulated agreement between the project applicant and EBMUD includes several measures to reduce project effects on migrating Mokelumne River fish. For example, whenever possible the southeast diversion station on Webb Tract (diverting from Franks Tract) would be used rather than the northeast station to reduce impacts on Mokelumne River fish. A Reservoir Island design review board would serve as an oversight committee for the Reservoir Islands while construction is ongoing. A Reservoir Island monitoring and action board would serve as a technical review committee for operations of the Reservoir Islands and for enforcing the implementation of the project Seepage Control Plan. These are now considered to be environmental commitments.

Improved Reservoir Island Levee Design

Based on the recommendations by Hultgren-Tillis Engineers contained in the 2003 document *Preliminary Design Report: Reservoir Island Levees, Delta Wetlands Project*, the proposed Reservoir Island levee design has been improved to provide increased stability and reduced through-levee seepage potential. The proposed Reservoir Island levee design now includes a more stable and flat reservoir-side slope, with a wider top width and a vertical cutoff trench to reduce seepage. The wider top width would allow future maintenance activities to place additional fill as needed to make up for any post-construction settling or sea-level rise while still providing minimum top widths and acceptable slopes after fill placement.

The design includes placement of fill and revetment on the landside slope, addition of a 10:1 to 14:1 slope interior toe berm, and addition of a 3-foot-wide core trench to reduce through-levee seepage potential. The new Reservoir Island levee design is described in more detail in Section 3.9, "Floodplain Management," which also includes an exhibit showing a typical levee cross section. Final levee design would be subject to engineering review.

Seepage Monitoring and Control Program

Though the new reservoir levee design reduces the risk of through-levee seepage damage, the risk of under-seepage to neighboring islands is still a concern. Deep sand aquifers underlie the Reservoir Islands and adjacent islands, as well as the channels and sloughs separating them. Storing water on the Reservoir Islands could increase the elevation of the groundwater surface and the hydraulic pressure on the aquifer, thereby inducing seepage through the sand aquifer onto the neighboring islands. Agricultural uses on neighboring islands could be impaired by an increase in seepage.

The project has designed a seepage monitoring and control program to avoid seepage issues and to provide early detection of seepage problems caused by the project. This program was described in detail in the 2000 RDEIR/EIS, Appendix H, and was subsequently updated in the EBMUD Protest Dismissal Agreement (discussed above). The seepage control portion of the program would consist of a series of interceptor wells or relief wells that would be used to regulate hydraulic pressure that could cause increased seepage to a neighboring property. The seepage monitoring portion of the program would use infrared aerial photography, weir monitoring, visual inspection, and piezometer readings on islands adjacent to the Reservoir Islands to quantify and document project-related seepage impacts, and to determine the basis for appropriate mitigation and compensation measures, if necessary. The seepage monitoring and control program sets forth a series of performance standards to determine net increases in seepage caused by the project as well as guidelines for evaluating the monitoring information. Diversions of water onto the project islands would continue only if seepage to adjacent and neighboring islands does not increase beyond existing conditions or if increases can be effectively mitigated.

WATER QUALITY

Water Quality Management Plan

The water quality management plan (WQMP) was developed as part of the protest dismissal agreement between the project and CUWA during the 2000 project water right hearing and was amended in 2013 to include taste and odor concerns from the urban water utilities that are diverting water from the Delta. This is an environmental commitment to manage the reservoir storage and discharges to minimize the drinking water quality impacts. The WQMP also was included as a condition of the protest dismissal agreement with CCWD. The CCWD agreement includes operational restrictions to reduce the impacts of the project on CCWD’s diversions and Los Vaqueros Reservoir salinity management and fish protection operations. A copy of the 2013 WQMP is attached as Appendix C.

A key principle of the WQMP is that “project operations shall minimize and mitigate for any degradation in the quality of drinking water supplies.” The major provisions of the WQMP address salinity and DOC concentrations at Delta export facilities. The WQMP requires the establishment of a water quality management board to review, approve, and implement the annual water quality operating plan. The operating plan would establish maximum Reservoir Island concentrations for salinity (total dissolved solids [TDS]), chloride, bromide, and total organic carbon (TOC). Measures to control impacts on exports and diversions would be established and implemented when project storage concentrations approach these maximum allowable concentrations. These measures generally involve adjusting discharges for export or releasing storage water during periods of high outflow to minimize potential impacts on exports and municipal water quality.

A monitoring program would be established to support and implement the WQMP for the project. Available California Data Exchange Center (CDEC) data would be incorporated into the water quality monitoring and reporting program to implement the water quality control measures. Hydrodynamic and water-tracking modeling would be used to calculate the effects of project discharges on water quality at CVP, SWP, CCWD, and other urban intakes. The WQMP covers short-term effects as well as a long-term accounting of the effects of project operations on exports and municipal water quality.

Short-term effects would be minimized using operational criteria. A short-term effect is defined by the WQMP as any adverse health effects, contribution to any non-compliance with drinking water regulations, and any increase in treatment or operation cost caused by increased concentrations of TOC or salinity. Project operations criteria would be established for TOC, bromide, and chloride, based on existing disinfection by-product regulations (DBP). These criteria would limit project discharges, unless the treatment plant operators agree that the additional water supply or other benefit of the project would compensate for the increased treatment expenses.

Project operations may not cause the TOC concentration at an export or diversion to increase more than 1 milligram per liter (mg/l), or cause the TOC concentration to exceed 4 mg/l. The reason being that if the TOC concentration were greater than 4 mg/l, a treatment plant may be required to provide more TOC removal (35% rather than 25%) prior to disinfection to minimize formation of DBP, which might increase the treatment costs, although DBP concentrations might be reduced accordingly.

Project operations also may not cause an increase in chloride of more than 10 mg/l, nor should any increase result in chloride exceeding 90% of the established chloride objective (e.g., 250 mg/l at Rock Slough). These operations criteria would limit project discharges to less than 20% of the exports if the project storage chloride concentration was more than 50 mg/l higher than the baseline chloride concentration.

In addition, the WQMP includes operations criteria for estimated effects at treatment plants. Project operations may not cause the modeled trihalomethane or bromate concentrations (e.g., using regression equations for TOC and bromide) at any treatment plant using Delta water to be greater than 80% of the established maximum contaminant level. The reason being that higher TOC or bromide concentrations might require higher treatment levels with associated cost.

The 2013 WQMP includes provisions to minimize taste and odor impacts at water treatment plants that are caused or contributed to by discharges from the Reservoir Islands. The 2013 WQMP measures ensure that project operations would not cause an increase in total nitrogen or total phosphorus, cause 2-methylisoborneol (MIB) and geosmin concentrations to exceed 8 nanograms per liter (ng/L), or cause algal toxins to reach problematic levels at one or more of the urban intakes. Also, as a general operating principle, the 2013 WQMP requires the project to manage algal growth on the Reservoir Islands to minimize the production of algal toxins, taste- and odor-producing algae, filter-clogging algae, and/or toxin-producing algae. As described under the “General Operating Principals” in the 2013 WQMP, algae would be managed through vegetation management, seasonal water operations, and limiting discharges when necessary.

COORDINATE WITH CALTRANS REGARDING WILKERSON DAM

If Alternative 3 is implemented, the project will consult with and obtain all required permits and approvals from Caltrans for the design and construction of Wilkerson Dam prior to the start of project-related construction activities.

2.4 WATER PROJECT OPERATIONS

The project would provide new water storage facilities in the central Delta (in-Delta storage) that would be used to increase the available water supply from the Delta in most years. Water would be diverted onto Webb Tract and Bacon Island (the Reservoir Islands) during high-flow periods (i.e., excess Delta outflow), typically in the winter months of December–March. Storage project storage water would be discharged into Franks Tract (from Webb Tract) or Old River and Middle River channels (from Bacon Island) for export when excess CVP or SWP pumping capacity is available, typically in the summer and fall months of July–November. Stored project water could be discharged to increase Delta outflow for improved water quality (i.e., reduced salinity) or estuarine habitat improvements in the fall months of September–November.

Project operations consist of the water diversions, storage, and discharges for export or for increased Delta outflow. Project operations begin with the diversion of excess Delta outflow to the Reservoir Islands. The full storage capacity of Webb Tract (100 taf) and Bacon Island (115 taf) can be filled in about 1 month through 64 screened diversions of about 86 cfs each. During the summer or fall months, project water would be discharged for export. Some of the project water would be exported and delivered directly to designated places of use. Other project water would be exported and transferred to groundwater banks within Semitropic and to the Antelope Valley Water Bank, with subsequent delivery to the designated places of use in dry years. Some project storage water may be released in the fall months to increase Delta outflow and thereby reduce salinity intrusion and improve the water quality of CCWD diversions and CVP and SWP exports.

Project operations were simulated with a monthly spreadsheet model developed by MBK Engineers (MBK). The project operations model is called In-Delta Storage Model (IDSM). The model formulations and assumptions are described in Appendix D, "Delta Wetlands Project In-Delta Storage Model." The project operations model begins with the results from a selected CALSIM baseline simulation. The 1922–2003 rainfall and runoff record used for the CALSIM baseline represents the existing hydrologic conditions (i.e., sequence) for this water project operations evaluation. The CALSIM model simulates the operation of the existing CVP and SWP reservoirs to meet the water supply demands in the CVP and SWP service areas.

This chapter describes the latest monthly CALSIM modeling of the existing CVP and SWP upstream reservoirs and existing Delta operations governed by SWRCB Water Right Decision 1641 (D-1641 adopted 1999, amended 2000), and describes the most likely pattern of project diversions to storage and subsequent discharges from storage for export or outflow augmentation. The delivery patterns to the designated places of beneficial water uses, and the intermediate storage in the designated groundwater banks, are fully disclosed and evaluated. Project operations were simulated and discussed most recently in Chapter 3 of the 2010 DEIR; there has been no change to the project's proposed operations since that EIR was certified in 2011.

The project operations described in this chapter and subsequently evaluated in Section 3.11, "Hydrology and Water Quality" and Section 3.4, "Aquatic Resources" were simulated using a CALSIM baseline that included D-1641 objectives without reverse Old and Middle River (OMR) flow restrictions, in order to conservatively evaluate the maximum possible project diversionseffects on fisheries. If the project operations were simulated using a CALSIM baseline that included restrictions on reverse OMR flows, the project's effects on fish, water quality, and hydrodynamics likely would be reduced compared to the simulated operations under D-1641. Please note that a particle tracking analysis of project diversion effects on fisheries that included OMR flow restrictions is discussed in Section 3.4, "Aquatic Resources."

Changes from the existing Delta flow conditions caused by the project operations are described in this chapter. Project diversions to storage would cause reductions in outflow; the export of stored project water would cause increased reverse OMR flows and increased SWP exports to the designated places of use or to the groundwater banks; and project discharges for salinity management or estuarine habitat would cause increased Delta outflow.

2.4.1 REVIEW OF PROJECT OPERATIONS FROM THE 2001 FINAL ENVIRONMENTAL IMPACT STATEMENT

The SWRCB and USACE joint evaluation of the project was described in the 1995 DEIR/EIS. The simulations of the project operations using the monthly DeltaSOS model from 1995 were changed for the 2000 RDEIR/EIS to reflect slightly different existing conditions results for the CVP-SWP operations model (DWRSIM) and to restrict project deliveries to the delivery deficits calculated in DWRSIM. The project was evaluated under the same D-1641 objectives with the same basic project storage and discharge rules (FOC) as are currently proposed and simulated with the IDSM. Because the same modeling and results from the 2000 RDEIR/EIS were used in the 2001 FEIS, a review of these project simulations is useful for identifying the changes that have occurred since the 2001 FEIS was prepared.

A relatively small change from the 1995 and 2000 modeling is the assumed Bacon Island and Webb Tract storage volumes. The maximum assumed project storage volume in the 1995 and 2000 simulations was 238 taf (at elevation of +6 feet msl), about 23 taf more than the current maximum storage of 215 taf (at elevation of +4 feet msl). This 10% reduction would cause a 10% reduction in the potential project diversion volume, but may not reduce the average project discharge for export, if the exports are constrained by unused pumping and delivery deficits in the designated places of use.

The major differences in the project operations simulated with the IDSM from the 1995 and 2000 DeltaSOS modeling are the specified monthly delivery of some exported project water to designated places of beneficial uses and the transfer of some exported project water to identified groundwater banks, for subsequent pumping and delivery to the designated places of beneficial uses in later years with delivery deficits (unmet demands). The 1995 project simulations with the DeltaSOS model assumed that any exported project water would be used by unidentified CVP or SWP contractors. The 2000 project simulations restricted project deliveries to the monthly CVP and SWP delivery deficits but did not designate specific contractors within the general CVP and SWP places of use. The previous modeling did not track delivery deficits in the designated places of use, did not simulate intermediate storage in groundwater banks, and did not check for physical capacity along the aqueducts for project deliveries. The IDSM project simulations do account for each of these important water supply factors. The IDSM model also simulates project releases in the fall to increase Delta outflow for salinity reduction and estuarine habitat improvement.

The project diversion criteria in the 1995 simulations included all of the D-1641 objectives (from the 1995 WQCP) to not interfere with CVP and SWP operations, and added some specific objectives to reduce potential impacts on fish habitat (X2) and water quality (Delta outflow). These diversion criteria were modified for the 2000 simulations to reflect the FOC. Both simulations limited project diversions to the months of September–March when the X2 position was downstream of Collinsville (81 km) and the 2000 simulations did not allow project diversions until the X2 position had been downstream of Chipps Island (75 km) for at least 10 days. The project diversions were limited to a fraction of the surplus outflow (i.e., above minimum outflow and within export/import [E/I] ratio) and to a fraction (25%) of the existing outflow. The X2 position could not be shifted upstream more than 2.5 km. The diversion flow would be limited further (50%) if the Fall Mid-Water Trawl (FMWT) index of delta smelt abundance was low (less than 239).

The 1995 and 2000 project discharge criteria (i.e., FOC) limited project discharge for export to a percentage (75%) of the available unused export capacity (11,280 cfs maximum capacity in most months) in order to reserve some export capacity for other water transfers. Webb Tract discharges for export were not allowed from January through June, and Bacon Island discharges for export were limited from April through June to 50% of the San Joaquin River flow. The project discharges for export simulated in 1995 with the DeltaSOS model were predominantly in the months of February–March and in the months of June–July.

The project diversions simulated in 1995 with the DeltaSOS model occurred predominantly in the months of October–February. The average annual simulated project diversion volume was 225 taf/yr for Alternative 2 (the Proposed Action). The 1995 DeltaSOS model did not limit the exports of project water to the unmet CVP and SWP water demands, so there were some years with a simulated filling in the fall, simulated discharge for exports in February, refilling in March, and discharge for exports in the summer (i.e., double-filling). This maximum project export assumption resulted in an average project discharge for export of 202 taf/yr.

The 2000 DeltaSOS model incorporated the FOC and limited the project deliveries to the CVP and SWP delivery deficits. The 2000 project simulations with this limited delivery resulted in an average diversion volume of 144 taf/yr with an average project discharge for export of 114 taf/yr. Because of limited demands for project water in wet years, project carryover storage was more than 50 taf in 16 of the 73 years (20% of years).

The major weakness with the 1995 project simulation with the DeltaSOS model was that exports were not constrained by demand or conveyance capacity; project exports were simulated in some very wet years when there would not likely have been actual need for the water supply. The 2000 project simulations were limited to the delivery deficits, and allowed water to remain in storage until there was a demand and unused export capacity. However, the 2000 project modeling did not include a groundwater bank and did not designate places of use within the CVP and SWP delivery areas. The IDSM accounts for the actual unmet water demands for specified SWP contractors, and allows some project water to be exported to the Semitropic and Antelope Valley groundwater banks for intermediate storage until delivery in a subsequent dry year to designated SWP contractors.

The assumed existing conditions for project monthly agricultural diversions and the assumed Habitat Island diversions remain the same as simulated in 1995 and 2000. Project implementation would cause a decrease in the existing agricultural diversions to the project islands (17,000 irrigated acres), representing about 5% of the Delta lowlands irrigated acreage (340,000 acres). The existing agricultural diversions to the project islands for summer irrigation and winter salt leaching are about 60 taf/yr. The Habitat Island diversions would be about 20 taf/yr.

2.4.2 NEW INFORMATION ABOUT PROJECT OPERATIONS

The 2000 Record of Decision (ROD) for the CALFED Bay-Delta Program (CALFED) directed DWR and Reclamation to study five surface storage proposals, including an in-Delta storage project that followed the project applicant's proposal for Bacon Island and Webb Tract. DWR completed an initial evaluation in May 2002, reporting that the in-Delta project was feasible but would require additional study to evaluate fully. DWR completed these evaluations in the 2004 Draft State Feasibility Study (California Department of Water Resources 2004). Public review of these studies led to further modeling and investigations that were reported in the 2006 Supplemental Report (California Department of Water Resources 2006). The reports prepared on separate topics concerning in-Delta storage are extensive and are available on the DWR website at: http://www.water.ca.gov/storage/indelta/index.cfm.

Several of the DWR studies of in-Delta storage were modeling evaluations of the potential future operations and water supply or environmental water releases that the in-Delta storage might provide if integrated with CVP and SWP facilities and operations. However, this SEIS evaluates the project only as an independent facility with no effects of or interference with CVP and SWP operations except when project discharges are exported at CVP and SWP facilities.

SIMULATION OF PROJECT OPERATIONS

The project water right decision, D-1643, includes several restrictions on the monthly project diversions and discharges for export pumping. These provisions, called FOC, were developed in 1997 during consultation with USFWS, NMFS, and DFW for the project BOs (for project compliance with the Federal and state Endangered Species Acts). An overall limit of 250 taf per water year was placed on the project exports. This eliminated the occasional filling, discharging, and refilling potential that was simulated in the 1995 DEIR/EIS evaluation. Not all FOC terms can be modeled; however, all FOC will be complied with in real-time daily operations. This SEIS simulates the FOC using CALSIM-derived monthly Delta flows and simulating project diversions in the December–March period and project discharges for export in the July–November period.

Additional restrictions to protect the water quality of Delta exports and diversions of municipal water supplies were required in the WQMP. The provisions of the WQMP were included qualitatively in the 2001 FEIS, but the effects of the monitoring, modeling comparisons, and potential project discharge restrictions were not included in the monthly project operations modeling. Therefore, the major provisions in the FOC and WQMP are summarized here to describe the linkage between these fish and water quality protective measures and the revised project operations evaluated in this SEIS.

The simulated project operations are simplified compared to the D-1643 criteria, so some of the adaptive management rules in the FOC may no longer be needed. Possible modifications in the project FOC are described here with some rationale for the proposed changes.

The project diversions (fish-screened) to storage typically would occur during the 4-month period of December–March. Outflow would remain above 11,400 cfs to position X2 downstream of Chipps Island. The project discharges for increased exports (i.e., water transfer) typically would occur during the 3-month period of July–September that is identified in the OCAP Biological Assessment (BA) (U.S. Bureau of Reclamation 2008) and briefly evaluated in the USFWS BO for delta smelt as the water transfer window when salvage of Chinook salmon, steelhead, delta smelt, and other fish of interest generally would be low. Some discharge for export to the groundwater banks would occur in the September–November period.

SWRCB will revise or issue project water rights that will include the actual criteria and objectives for controlling the project operations in the Delta and for conveyance (pumping) and groundwater storage and place of use deliveries.

Final Operating Criteria Diversion Measures

Measure 1 limits September–November diversions unless X2 is located downstream of Chipps Island (75 km), which requires an outflow greater than 11,400 cfs. September–November diversions are not simulated because the Delta outflow is rarely greater than 11,400 cfs in these months.

Measure 2 limits September–March diversions unless X2 is downstream of Collinsville (outflow > 7,100 cfs), and downstream of Montezuma Slough (outflow >8,000 cfs) if the FMWT delta smelt index is less than 239. The FMWT delta smelt index cannot be simulated. The SEIS simulation allows project diversions only if X2 is downstream of Chipps Island (outflow > 11,400 cfs).

Measure 3 limits the upstream shift of X2 to less than 2.5 km. Because of the logarithmic effect of outflow on X2, this is equivalent to about 25% of the outflow.

Measure 4 eliminates project diversions in April and May for fish protection, and eliminates diversions from February 15 to March 31 if the previous FMWT delta smelt abundance is less than 239. The FMWT provision will need to be reviewed during re-consultation for updated project BOs from USFWS, NMFS, and DFW to be more consistent with the current Delta operations specified in the OCAP BOs.

Measure 5 limits the project diversions to a monthly specified fraction of the surplus Delta outflow, calculated using the D-1641 required outflow and E/I objectives. The specified fraction is 90% for December and January, 75% in February, and 50% in March. A monthly average of 3,500 cfs would fill the project storage capacity. With full CVP and SWP permitted pumping of about 11,280 cfs, filling of the project would occur when Delta inflow was greater than about 30,000 cfs for 65% E/I months (December–January) and when inflow was greater than 52,500 cfs for 35% E/I months (February and March). The outflow would remain above 11,400 cfs for the 65% E/I months and above 34,000 cfs for the 35% E/I months. These project operations criteria are more restrictive than the E/I ratio itself, and could be reviewed during re-consultation.

Measure 6 limits the project diversions to a specified monthly fraction of the outflow (without the project diversions). The fraction in December is 25% and the fraction in January–March is 15%. This measure would limit the project diversions whenever Delta outflow was less than about 25,000 cfs.

Measure 7 limits the project diversions for 15–30 days as selected by fish agencies to a specified fraction of the San Joaquin River inflow to protect delta smelt spawning and rearing in the south Delta. This measure may be reviewed during re-consultation to be more consistent with the current Delta operations specified in the OCAP BOs from USFWS and NMFS.

Measure 8 requires a fish monitoring program during the diversion period. If delta smelt are detected nearby, the project diversions must be reduced by half until no delta smelt are detected. This requirement will be complied with in real-time daily operations but cannot be simulated. The fish monitoring provisions may be reviewed during re-consultation.

Measure 9 limits the project diversions in November–January when the Delta Cross Channel gates are closed for fish protection (Chinook). This measure reduces the daily diversion to 3,000 cfs when total inflow is less than 30,000 cfs, and to 4,000 cfs when total inflow is less than 50,000 cfs. This is a moderate restriction on the project diversions which would already be limited by the E/I ratio and allowable SWP and CVP exports. This measure may be reviewed during re-consultation for updated BOs.

Measure 10 allows specified monthly diversions to match evaporation losses on the Reservoir Islands from June through October. These diversion values are similar to existing agricultural diversions.

Most of these FOC diversion restrictions are satisfied with the SEIS simulated monthly operations that allow diversions in December–March with a minimum Delta outflow of 11,400 cfs, and the project diversions would be treated as exports within the maximum D-1641 E/I ratio. These criteria would minimize entrainment impacts and provide low–electrical conductivity (EC) storage water (see Section 3.11, "Hydrology and Water Quality"). The FOC could be modified to match the monthly diversion rules simulated with IDSM. The FOC are also subject to final permit conditions from USFWS, NMFS, and DFW.

Final Operating Criteria Discharge Measures

Measure 1 limits Bacon Island discharges to 50% of the San Joaquin River flow from April through June. This SEIS assumes project discharges for export will occur July–November.

Measure 2 does not allow Webb Tract discharges from January–June.

Measure 3 does not allow Habitat Island discharges to be exported.

Measure 4 limits project discharges in July to 75% of the unused permitted export capacity. This was not simulated for the SEIS to allow maximum possible project exports to designated places of use or the groundwater banks.

Measure 5 allocates some project storage water to be used for increased Delta outflow to improve estuarine habitat. However, this was assumed to be about 10% (20% if FMWT index <239) of the discharges for export made from December–June. The SEIS simulated operations assumed discharges will occur July–November, but simulated releases (1,000 cfs) for Delta outflow in the fall of some years when export capacity was not available if water was available in storage and Delta salinity was high (e.g., chloride of 125 milligrams per liter [mg/l] at CCWD). This measure may be reviewed during re-consultation.

Measure 6 requires a fish monitoring program during the discharge period. If delta smelt are detected in Old River or Middle River, the project discharges must be reduced by half until no delta smelt are detected. This requirement will be complied with in real-time daily operations but cannot be simulated. Delta smelt are not expected to be detected in the vicinity of the project in the July–November period.

As with the diversion measures, the FOC related to discharge are subject to final permit conditions from USFWS, NMFS, and DFW.

Water Quality Management Plan Measures

The WQMP was developed during the 2000 water rights hearing as part of a protest dismissal agreement with CCWD and CUWA and amended in 2013 to include taste and odor concerns from the urban water utilities that are diverting water from the Delta. The major provisions of the WQMP address salinity and dissolved organic carbon (DOC) concentrations at the exports and municipal diversions. A key principle of the WQMP is that "project operations will minimize and mitigate any degradation in the quality of drinking water supplies." The WQMP requires the establishment of a water quality management board to review, approve, and implement the annual water quality operating plan. The operating plan will establish maximum storage concentration for salinity (total dissolved solids [TDS]), chloride, bromide, and total organic carbon (TOC). Measures to control impacts on exports and diversions will be established and implemented when the project storage concentrations approach these maximum allowable concentrations. These measures generally involve adjusting discharges for export or releasing storage water during periods of high outflow to minimize potential impacts on exports and diversion water quality.

A monitoring program will be established to support and implement the WQMP. Available California Data Exchange Center (CDEC) data will be incorporated into the water quality monitoring and reporting program to implement the water quality control measures. Hydrodynamic and water tracking models will be used to calculate the effects of the project discharges on water quality at municipal water intakes. The WQMP covers short-term impacts as well as a long-term accounting of the effects of project operations on export and diversion water quality.

Short-term impacts will be minimized using operational criteria. A short-term impact is defined by the WQMP as any adverse health effects, contribution to any non-compliance with drinking water regulations, and any increase in treatment or operation cost caused by increased concentrations of TOC or salinity. The project operations criteria are established for TOC, bromide, and chloride based on existing DBP regulations. These criteria do not necessarily limit the project discharges, if the treatment plant operators agree that the additional water supply or other benefit of the project discharges would compensate for the increased treatment expenses. Not all WQMP measures can be modeled; however, all WQMP terms will be complied with in real-time daily operations. (See also Section 3.11, "Hydrology and Water Quality.")

The 2013 WQMP includes provisions to minimize taste and odor impacts at water treatment plants that are caused or contributed to by discharges from the Reservoir Islands. The 2013 WQMP measures ensure that project operations would not cause an increase in total nitrogen or total phosphorus, cause MIB and geosmin concentrations to exceed 8 ng/L, or cause algal toxins to reach problematic levels at one or more of the urban intakes. Also, as a general operating principle, the 2013 WQMP requires the project to manage algal growth on the Reservoir Islands to minimize the production of algal toxins, taste- and odor-producing algae, filter-clogging algae, and/or toxin-producing algae.

IN-DELTA STORAGE MODEL

The primary source of new information to describe the likely project operations was a monthly water supply model prepared by MBK (attached as Appendix D). This model uses the results from the CALSIM monthly model with the existing level of development (2005) for facilities and water demands to describe existing Delta conditions without the project. The project operations were simulated with the spreadsheet model, and the project diversions to storage and the project releases for increased export or for increased Delta outflow were simulated and summarized in tables and graphs.

This MBK model supersedes DeltaSOS, which was the monthly spreadsheet model of 1922–1991 operations used for the 1995 DEIR/EIS. The MBK model of the monthly project operations, called IDSM (In-Delta Storage Model), is the major source of information for the changes in Delta water management that would result from the project operations. The IDSM includes the project diversions to storage, releases for export, conveyance to places of use, and conveyance to the groundwater storage banks located along the California Aqueduct for supplemental storage of project water until needed at the designated places of use.

The IDSM simulates the diversion of excess Delta outflow to the project storage islands in the winter months of December–March, and the discharge of project water for increased export in the summer and fall months of July–November. The IDSM has the ability to simulate some project water being delivered directly to designated places of use in some years and some project water being stored in groundwater banks until needed in the designated places of use. The IDSM also simulates the discharge of some project water to increase Delta outflow for salinity management and estuarine habitat in the fall months of some years.

2.4.3 PROJECT SIMULATION

The 1995 DEIR/EIS analyzed three project alternatives compared to an existing conditions baseline. Alternatives 1 and 2 both consisted of water storage on two Reservoir Islands and implementation of an CMP on two Habitat Islands. The only difference between the two alternatives was the assumed operational criteria for the discharge of stored water. Under Alternative 3, all four project islands would be used as reservoirs and only limited compensation wetland habitat would be provided on a portion of Bouldin Island (north of SR 12). Alternative 3 would be inconsistent with the project BOs and FOC.

Alternative 2, with the highest amount of discharge for export pumping and delivery to designated places of use, would have the maximum potential effects on water quality, hydrodynamics, and fisheries associated with project diversions and discharges. Alternative 2 was therefore used to represent the proposed project operations in the 1997 BA for fish species. The terms and conditions of the USFWS, NMFS, and DFW BOs were based on Alternative 2 operations. This SEIS simulates the Proposed Action, which is Alternative 2 as amended by the inclusion of the FOC. The simulation of the Proposed Action encompasses the full range of impacts associated with Alternatives 1 and 2. Alternative 3 is not simulated in this SEIS because the impacts would be consistent with the 2001 FEIS conclusions and because Alternative 3 would be inconsistent with the BOs and FOC.

Several monthly modeling assumptions are used that may not apply in actual, real-time daily project operations. The actual project operations will follow the specified conditions in the water rights, the WQMP, and the revised BOs from USFWS, NMFS, and DFW. The monthly modeling of the project is adequate for evaluating the general frequency and magnitude of the likely environmental impacts resulting from the operation of the project in the Delta, in comparison with the existing CVP and SWP operations under D-1641.

It is likely that the future Delta configuration and/or operating criteria may be changed with implementation of the Bay Delta Conservation Plan (BDCP) or other Delta fish protection and habitat restoration efforts discussed in Section 3.0.6, “Cumulative Context.” The basic FOC and WQMP rules and objectives for the project operation are likely to remain similar and could allow the project to operate in a comparable fashion to that described and evaluated under the existing D-1641 objectives. Therefore, the future water quality and fish impacts are expected to be similar in magnitude to those described for the simulated monthly project operations evaluated in this SEIS in Section 3.11, “Hydrology and Water Quality,” and Section 3.4, “Aquatic Resources.”

2.4.4 Central Valley Project and State Water Project Existing Conditions

The CALSIM simulation of existing conditions was used to evaluate the environmental impacts from project operations as required by CEQA. Existing conditions (i.e., no-project conditons) refers to the current system of CVP and SWP reservoirs with the current flood control storage and minimum outflow constraints, current CVP and SWP water supply demands, and current Delta water quality objectives and constraints as required under SWRCB water right decision D-1641. The simulated existing conditions also provide the basis for evaluating the potential project benefits for increased water supply and Delta salinity and fish habitat improvements.

The CALSIM model simulates the CVP and SWP operations, assuming a repeat of the inflow hydrology (rainfall-runoff) for 1922–2003 (an 82-year sequence) but with existing:

- reservoirs and upstream diversions,
- Delta pumping facilities,
- water demands, and
- regulatory requirements for
  - maximum reservoir flood control storage,
  - minimum reservoir release flows, and
  - Delta flow and water quality (i.e., salinity) objectives.

This section presents the water supply conditions in California that are relevant to the potential project operations. Because the project would be operated independently of the CVP and SWP, no changes in upstream reservoir operations or Delta inflows would be caused by project operations.

The existing Delta flow conditions can be characterized by the monthly inflows, Delta outflow, and the CVP and SWP exports. Various flows within the Delta channels also may be of interest for water quality and fishery effects. The Delta outflow requirements often control (limit) the exports. The CVP and SWP exports sometimes are controlled by the monthly E/I ratio and may be limited by the permitted pumping capacity, available storage in San Luis Reservoir, or monthly water demands. The CALSIM model provides an integrated description of the water management operations that result from these multiple Delta criteria and operational limits. The project diversions and discharges would not change these CVP and SWP operations and would not affect compliance with the D-1641 objectives.

As was done for the 1995 DEIR/EIS, these simulated Delta flows from the CALSIM model would be compared to the historical Delta inflows and exports that are recorded in the DWR database DAYFLOW. The monthly Delta inflows, outflow, exports, and water deliveries from the most recent years (since the 1995 WQCP objectives) are anticipated to compare favorably (i.e., match) with the simulated CVP and SWP conditions. This comparison would provide confidence in the simulated CALSIM results that subsequently would be used in IDSM to simulate the likely project operations, for specified monthly project operating criteria.

The CALSIM model uses a water year framework for simulating CVP and SWP reservoir and Delta operations. The monthly results for Delta inflows, Delta outflow, and the CVP and SWP exports are usually evaluated with a month *x* year format table. The CALSIM results provide the monthly cumulative probability distribution for the Delta inflows and the corresponding allowable exports and outflow. The monthly cumulative distribution will be summarized with the minimum (0%), and the incremental 10% cumulative distribution values to the maximum (100%) and the average value for the 82-year sequence of 1922–2003. Monthly flows are expected to be higher than the median value in 50% of the years and less than this value in 50% of the years. For some variables, the cumulative distribution from the more recent 41-year sequence of 1963–2003 would be compared. The recent monthly sequences for 1980–2003 are used for the fish entrainment assessment because the CVP and SWP salvage fish density are considered most reliable for this period of the CALSIM simulation.

Sacramento River Flows at Freeport

Table 2-5 gives the CALSIM-simulated monthly cumulative distributions of Sacramento River flows at Freeport for existing conditions for 1922–2003. For example, the simulated minimum October flow was 7,590 cfs, and the simulated median (50%) October flow was 11,720 cfs. The simulated maximum (100% October flow was 36,228 cfs, and the average simulated October flow was 12,149 cfs. The cumulative distribution of the annual (water year) flow volume (taf) is given in the right-hand column. The minimum simulated December flow was 6,703 cfs, the median December flow was 16,785 cfs, and the maximum December flow was 72,281 cfs. The minimum simulated annual Sacramento River flow was 6,252 taf, the median simulated annual flow was 13,931 taf, and the maximum simulated annual flow was 34,969 taf. The Sacramento River channel capacity at Freeport is about 80,000 cfs. At higher Sacramento River flows, water is diverted (spilled) into the Yolo Bypass at the Fremont Weir and at the Sacramento Weir. For ease of readability, all tables are provided at the end of this chapter.

The CALSIM-simulated distribution of monthly Sacramento River flows for the recent 1963–2003 period was generally similar, but was higher in some months. The median annual flow was 18,345 taf for the 1963–2003 period compared to 13,931 taf for the full period. The average annual flow was 17,396 taf, compared to an average of 16,201 taf for the full period.

The historical Sacramento River monthly flows for the 1963–2003 period were very similar to the simulated Sacramento River flows for this same period. The median monthly flows were similar, and the median and average annual flows were nearly identical. This indicates that the CALSIM simulations of the upstream reservoirs, with existing reservoir operations and existing upstream diversions, remain similar to the historical conditions for this recent period.

Yolo Bypass Inflows

Because the project diversions would occur during high-flow periods, the monthly distribution of Yolo Bypass inflows is also of interest. Yolo Bypass flows occur when daily flows at the mouth of the Feather River exceed about 55,000 cfs (because the river elevation exceeds the weir crest). However, there can be flood peaks that exceed this threshold for several days within the month, so there can be some Yolo Bypass monthly flows when the Sacramento River at Freeport monthly flows are above 30,000 cfs.

Table 2-6a gives the CALSIM-simulated monthly cumulative distribution values for the Yolo Bypass flows for 1922–2003. Table 2-6b indicates that Yolo Bypass flows for the second half of the record (1963–2003) were a little higher than for the entire period. Table 2-6c indicates that the historical Yolo Bypass flows for 1963–2003 were a little higher than the simulated values for this period. There were a few years with Yolo Bypass monthly flows of more than 1,000 cfs in October and November and in May and June, but the majority of the Yolo Bypass flows were in the months of December–April. Yolo Bypass flows of more than 4,000 cfs (enough to fill project storage in a month) were simulated in about 20% of the years for December, about 25% of the years in January, about 30% of the years for February, and about 20% of the years for March. This is a rough indication of the frequency that high runoff from the Sacramento River would occur.

In wet years, the Yolo Bypass flows may be high for several months. The cumulative distribution of annual volumes (right-hand column) indicates that the Yolo Bypass flow volume would be greater than 215 taf (project storage volume) in about 60% of the years. The Yolo Bypass flow volume was simulated to be greater than 1,000 taf in about 40% of the years. This generally indicates that the Sacramento River runoff is high enough to spill into the Yolo Bypass for at least a month, with the most common months being January–March. This is the period when the project would fill the storage islands.

San Joaquin River Flows at Vernalis

Table 2-7a shows the CALSIM-simulated monthly cumulative distributions of San Joaquin River flows at Vernalis for the 1922–2003 hydrology sequence. Because there are major water supply reservoirs and substantial irrigation diversions on the upper San Joaquin River (Friant Dam), on the Merced River (New Exchequer Dam), on the Tuolumne River (New Don Pedro Dam), and on the Stanislaus River (New Melones Dam), the San Joaquin River flow at Vernalis is highly regulated. The median flows in all months are between about 1,500 cfs and 5,000 cfs. In the summer and fall months of some dry years, the minimum dilution flows needed to meet the D-1641 salinity criteria at Vernalis may require releases from New Melones reservoir. The great majority of the simulated San Joaquin River flows are less than 5,000 cfs, and most summer and fall months have flows of less than 2,000 cfs.

Table 2-7b shows the simulated Vernalis flows for the second half of the simulation period, from 1963 to 2003. The average annual flow volume was 3,470 taf, which is 15% more than the average annual volume of 3,039 taf for the entire 82-year period. Therefore, the average annual San Joaquin River flow volume for the first half of the period was only 2,608 taf (85% of average). Table 2-7c indicates that the historical flows for 1963–2003 were about the same as the simulated flows for this period. The CALSIM-simulated median flows are higher than historical flows for April and May (perhaps because of Vernalis Adaptive Management Plan [VAMP] pulse flows) and lower in January and February (perhaps because of the increased reservoir storage capacity compared to the historical operations).

Total Delta Inflows

Table 2-8a gives the monthly cumulative distributions of the CALSIM-simulated total Delta inflow for 1922–2003. The total Delta inflows are highly regulated by the upstream reservoirs, so the median monthly flows range from about 15,000 cfs in September–October and November to about 45,000 cfs in February. Table 2-8b gives the CALSIM-simulated monthly flow distributions for the 1963–2003 period. The average annual inflow volume was about 22,000 taf for the 1922–2003 period, but was about 10% higher (24,276 taf) in the second half of the hydrologic sequence. The average annual inflow was therefore about 10% lower than the average in the first half of the period.

Table 2-8c indicates that the historical monthly total inflows were very similar to the simulated monthly total inflows for the 1963–2003 period. The historical average annual inflow was 25,407 taf. The historical and simulated average (and median) monthly flows were very similar for most months. The simulated median flows were about 10% lower than the historical median flows in December–March. The simulated median December total inflow was about 20,000 cfs, the median January flow was about 30,000 cfs, the median February flow was about 42,000 cfs, and the median March inflow was 33,000 cfs.

The total Delta inflow is used in D-1641 to limit the allowable SWP and CVP exports. This objective is referred to as the E/I ratio. Exports cannot exceed 65% of the inflow during the July–January period, and they cannot exceed 35% of the inflow during the February–June period (the February E/I is 45% in some years with January runoff of less than 1 million acre-foot [maf]).

The total Delta inflow is an important flow parameter because it is assumed that the project diversions to storage also would be limited by the E/I ratio. This allows a minimum monthly inflow for potential project diversion to be calculated. For example, in December and January with the maximum E/I objective at 65%, the Delta inflow would need to be about 20,000 cfs to allow 11,280 cfs exports and about 23,000 cfs to allow 15,000 cfs exports. Because project diversions of 4,000 cfs would be allowed (within the E/I objective) only if the outflow was greater than 15,000 cfs, the total Delta inflow would be greater than 30,000 cfs in December or January to allow project diversions.

For February and March, with the maximum E/I objective at 35%, the total Delta inflow would be greater than 32,000 cfs to allow 11,280 cfs export and greater than 43,000 cfs to allow full capacity exports of 15,000 cfs. project diversions of 4,000 cfs therefore would be allowed when total Delta inflow was greater than about 55,000 cfs in February or March. The Delta outflow would be greater than 35,000 cfs for full capacity exports of 15,000 cfs.

Table 2-8a gives the percentage of the years with enough total Delta inflow to allow full capacity CVP and SWP exports and also project diversions of at least 2,000 cfs. For December, the 30,000-cfs threshold for project diversions is exceeded at the 80% cumulative distribution value. Project diversions would be possible in about 20% of the years in December. The January total Delta inflow is greater than 30,000 cfs in about 50% of the years. For February, the 55,000-cfs threshold for full capacity CVP and SWP exports and project diversions is exceeded in about 40% of the years. The March total Delta inflow is greater than 55,000 cfs in about 30% of the years. The IDSM uses the CALSIM total Delta inflow to simulate the opportunity for project diversions, given the specified constraints for monthly required Delta outflow and other specified project operational parameters.

DELTA CHANNEL DEPLETIONS

Table 2-9a gives the monthly estimated gross channel depletion flow for irrigation diversions and evaporation used in the DAYFLOW water budget accounting by DWR. The monthly values are assumed to be constant from year to year. The total annual gross depletion attributable to Delta consumptive use is estimated to be 1,684 taf. Table 2-9b gives the monthly cumulative distributions of channel depletion (net) flow for the recent 1963–2003 period from DAYFLOW that accounts for both estimated consumptive use and precipitation. The summer net depletion values are nearly equal to the gross depletion values since rainfall is rare in these months. The average net depletion was about 736 taf.

Table 2-9c gives the monthly cumulative distributions of gross channel depletion flows for the recent 1963–2003 period from CALSIM. The CALSIM model uses variable channel depletions that vary with the estimated weather and soil moisture conditions. The July and August values are lower than the DAYFLOW estimates. The annual gross channel depletion estimate was 1,318 for the 1963–2003 period. This is about 80% of the DAYFLOW estimate. Table 2-9d gives the monthly cumulative distributions of net channel depletion flow (cfs) for the recent 1963–2003 period from CALSIM. The average annual channel depletion is estimated to be 663 taf. The average net channel depletion estimates are similar. The net channel depletions are assumed to be diverted for irrigation of the Delta agricultural lands. These Delta consumptive uses always will be supplied from the total Delta inflow. The Delta outflow will be the total Delta inflow minus the Delta depletions minus the exports.

2.4.5 Central Valley Project and State Water Project Water Demands and Deliveries

Understanding the monthly CVP and SWP water supply demands is important to evaluate the water supply effect from the project operations because the project is considered as a supplemental water supply for years when the full CVP and SWP water demands cannot be delivered with existing facilities and Delta operations.

Central Valley Project Water Supply Demands

South-of-Delta CVP demands include agricultural and municipal needs served from the San Luis Reservoir and San Felipe Unit, the Cross Valley Canal, the DMC and Mendota Pool. These CVP demands also contain exchange contractors, refuge water supplies, and operational losses. The monthly demand patterns are determined based on recent historical CVP deliveries. CVP demands south of the Delta are always set to contract amount and do not vary based on hydrologic conditions in CALSIM. The water supply allocations (i.e., percentage of demand) for each contract year (i.e., March–February) are estimated in the CALSIM model based on reservoir storage and projected hydrologic conditions.

The total CVP water supply demand at the CVP Jones Pumping Plant is about 3,475 taf/yr. This includes 875 taf/yr for the San Joaquin River exchange contractors, about 1,965 taf/yr for agricultural uses, about 150 taf/yr for municipal uses, and about 300 taf/yr for refuges located in the San Joaquin River and Tulare River basins that must be supplied from CVP Jones pumping. The CVP losses to evaporation and canal seepage are assumed to be about 185 taf/yr (about 5% of demands) in the CALSIM model. There is an additional Cross Valley Canal demand of 128 taf/yr that the SWP has agreed to wheel (pump for CVP at the SWP Banks facility) to allow an exchange of CVP Friant water.

Table 2-10a gives the constant monthly CVP demands assumed in the CALSIM model. Because of the recent increases in the wildlife refuges' water supply deliveries and the limited CVP Jones pumping capacity, the CVP can rarely deliver the full south-of-Delta demands. Table 2-10b shows the monthly cumulative CVP delivery volumes (taf) for the simulated 1922–2003 period. The cumulative distribution of CVP annual delivery is given at the right-hand side of the table. Table 2-10c shows the monthly cumulative distribution of CVP agricultural deliveries. The exchange contractors and refuges and municipal supply are given higher allocations, so most of the shortage in CVP deliveries is for the agricultural contractors. The average agricultural delivery was about 1,064 taf/yr compared to the full agricultural demand of about 1,963 taf/yr (55% average allocation).

Exhibit 2-14 shows the CALSIM-simulated annual CVP deliveries for 1922–2003. The CVP deliveries ranged from a minimum of 1,412 in 1933 to a maximum of 3,334 in 1983. The annual delivery was never as high as the full demands of 3,475 taf. The CVP deliveries were greater than 90% of the demands in eight of the 82 years (10% of the years). The CVP deliveries were greater than 80% of demands in 25 years (30% of the years). The CVP deliveries were less than 50% of demands in eight years (10% of the years). Because of limited Jones pumping capacity and pumping restriction for fish protection in the spring months, it would be difficult to increase these CVP deliveries without wheeling water at the SWP Banks Pumping Plant. The existing conditions CALSIM simulation assumed that the Delta-Mendota Canal/California Aqueduct Intertie (DMC-CA Intertie) was built and operating, allowing full CVP Jones pumping of 4,600 cfs in each month.

Central Valley Project Jones Pumping Plant Capacity

The CVP Jones Pumping Plant has an authorized capacity of 4,600 cfs. This is equivalent to 9,125 acre-feet per day (af/day). Table 2-11 compares the CVP monthly demands to the maximum possible CVP Jones monthly pumping. The full CVP monthly demands usually exceed the CVP monthly pumping capacity in the May–August period. Water must be stored in San Luis Reservoir during the winter period to supply the full CVP demands. If the CVP Jones Pumping Plant were at maximum capacity for the entire year, about 3,330 taf/yr could be delivered from the Delta (about 275 taf each month). This is unlikely to occur, however, because there are required periods for maintenance of the pump units, and the hydrology in the Delta may not allow full pumping every day of the year.

The Central Valley Project Improvement Act (CVPIA) has introduced additional constraints on the CVP Jones pumping capacity. A portion of the Section (b)(2) water that is dedicated to anadromous fish restoration purposes (maximum of 800 taf) normally is allocated by USFWS to reduce CVP Jones pumping during the VAMP period (April 15–May 15), and additional pumping reductions are often applied during the remainder of May and June (normally a 3,000-cfs limit in May and June outside the VAMP period) and at times during fish-sensitive periods in December–March. Therefore, under current regulations, it is difficult for the CVP Jones facility to supply the full CVP demands. During some wet years, flows from the upper San Joaquin River (Friant Dam) and the Kings River can meet San Joaquin River Exchange Contractor demands at Mendota Pool and allow CVP Jones pumping to supply other CVP contractor demands.

Table 2-12a gives the monthly cumulative distribution of CALSIM-simulated CVP Jones pumping for the 1922–2003 hydrologic sequence. CVP Jones pumping is typically near capacity in most months of many years. Pumping often is reduced in April, May, and June for fish protection actions (VAMP and CVPIA [b][2] water). The maximum CVP Jones pumping was only 2,912 taf, considerably less than the full demands of 3,474 taf. Table 2-12b gives the monthly cumulative distribution of CALSIM-simulated CVP Jones pumping for the 1963–2003 hydrologic sequence. CVP Jones pumping was slightly higher in the second half of the record. Table 2-12c gives the monthly cumulative distributions of historical CVP Jones pumping for 1963–2003. The CVP Jones historical pumping was seasonal in the first 5 years because the San Luis Reservoir was not completed and operated for winter storage of CVP water until 1968. The historical CVP pumping has been very similar to the simulated CVP pumping for the past 35 years, with nearly full capacity CVP pumping year-round.

The planned Delta-Mendota Canal – California Aqueduct (DMC-CA) Intertie facility would allow slightly more CVP water to be pumped at the CVP Jones Pumping Plant and pumped at the Intertie Pumping Plant to the CA in the winter months and stored in CVP San Luis Reservoir until the summer period. Because the CVP Jones Pumping Plant is near capacity in most months of almost every year, there are only limited times when additional water supply from project storage could be pumped at the CVP Jones Pumping Plant and transferred to CVP contractors.

State Water Project Water Supply Demands

The 29 SWP contractors that divert from the Delta have a combined contract amount (Table A) of 4,133 taf/yr (California Department of Water Resources 2008). This is the maximum future demand that the SWP is obligated to meet. Additional SWP pumping can occur under Article 21 of the contracts (i.e., interruptible water) when there is surplus Delta flow and the SWP portion of San Luis Reservoir is full.

Metropolitan is the largest SWP contractor with a Table A contract amount of about 1,912 taf, nearly half of the combined contract amount. There are 12 other SWP contractors in southern California, with Table A contract amounts that total 580 taf. These SWP deliveries must be pumped over the Tehachapi Mountains at the Edmonston Pumping Plant. The Edmonston Pumping Plant has 14 units that each can pump 320 cfs, for a maximum of 4,480 cfs. However, at least one unit normally is held in reserve, so the maximum annual delivery over the Tehachapi Mountains to southern California contractors is limited to about 3 maf. Delivery of the maximum Table A contract amounts of 2,500 taf would require operating the Edmonston pumping units at about 85% of capacity.

The San Joaquin Valley agricultural contractors have a combined contract amount of about 1.2 maf (the Kern County Water Agency has a maximum Table A contract of 1 maf). The South Bay aqueduct contractors have a total Table A amount of 220 taf. The other SWP contractors have a total Table A amount of about 130 taf; some of this water is pumped at the North Delta Pumping Plant on Barker Slough.

Table 2-13a shows the monthly cumulative distribution of CALSIM-simulated SWP Table A (i.e., firm water) deliveries for the 1922–2003 period. The cumulative distribution of annual SWP Table A delivery is given at the right side of the table. The Table A delivery is the allocated portion of the Table A maximum contract amounts each year. This water is delivered on a monthly pattern that is assumed to shift slightly with water allocation. The Table A deliveries ranged from a minimum of 1,100 taf to a median of 2,750 taf and a maximum of 3,500 taf.

Table 2-13b shows the monthly cumulative distributions of CALSIM-simulated SWP carryover (i.e., Article 56) deliveries for the 1922–2003 period. The CALSIM model simulates some carryover of Table A water in SWP San Luis Reservoir that is delivered in January–March of the next water year. This is a way for SWP contractors to shift deliveries from one year into the next. However, this reduces the deliveries in one year as a hedge (insurance) for the next year's deliveries. The CALSIM model simulated average carryover storage was 243 taf/yr with 60% of the years having more than 200 taf of shifted deliveries.

Table 2-13c shows the monthly cumulative distributions of CALSIM-simulated SWP interruptible (i.e., Article 21) deliveries for the 1922–2003 period. This is water that can be delivered to SWP contractors with local storage facilities (i.e., reservoir or groundwater bank) in months when SWP San Luis Reservoir is full and there is surplus water in the Delta (within the E/I objective). The CALSIM model assumes that relatively high (5,000 cfs) Article 21 deliveries can be made to MWD and other SWP contractors. The project operations would not interfere with these Article 21 deliveries.

Table 2-13d gives the monthly cumulative distributions of CALSIM-simulated total SWP deliveries for 1922–2003. The monthly distribution of total SWP delivery is seasonal, with highest delivery in summer months and lowest in the winter months. The maximum annual SWP delivery was highest in years with substantial Article 56 carryover and Article 21 interruptible deliveries.

Exhibit 2-15 shows the CALSIM-simulated annual SWP deliveries for 1922–2003. The total SWP deliveries ranged from 1,229 taf in 1977 to 5,342 taf in 1983. The total SWP delivery was greater than 4,100 taf (full Table A contract amount) in 15 of the 82 simulated years (18% of the years). The total SWP delivery was greater than 90% of the Table A contract amount in 32 years (40% of the years). The total SWP delivery was less than 50% of the Table A contract amount in 12 of the 82 years (15% of years).

STATE WATER PROJECT BANKS PUMPING CAPACITY

SWP Banks Pumping Plant has an installed capacity of about 10,668 cfs (two units of 375 cfs, five units of 1,130 cfs, and four units of 1,067 cfs). The SWP water rights for diversions specify a maximum of 10,350 cfs. With full diversion capacity (20,530 af/day) each day of the year, SWP Banks Pumping Plant theoretically could pump about 7,500 taf each year. However, the current permitted Clifton Court Forebay (CCF) diversion capacity of 6,680 cfs would provide a maximum delivery of about 4,836 taf/yr. Additional permitted CCF diversions of one-third of the San Joaquin River at Vernalis are allowed under the current permit rule for a 90-day period from December 15 to March 15, if the Vernalis flow is above 1,000 cfs. The maximum permitted CCF diversions still would be less than 5,000 taf/yr.

The assumed CALSIM monthly Table A SWP demands (estimated from historical delivery patterns) and the permitted SWP Banks pumping capacity are given in Table 2-10. The seasonal SWP demands are highest in the summer months, requiring a portion of the demands to be supplied from San Luis Reservoir storage. San Luis Reservoir releases are also often needed during the spring months of April through June because SWP Banks pumping is limited during April–June by a combination of VAMP export reductions and the 35% maximum export/inflow ratio specified in D-1641 from February through June.

Table 2-15a gives the monthly cumulative distribution of CALSIM-simulated SWP Banks pumping for the 1922–2003 hydrologic sequence. Some of this SWP pumping was CVP water (i.e., wheeled Cross Valley Canal deliveries). There was more variation in the monthly SWP Banks pumping than in the CVP Jones pumping, with lower pumping in drier years and very high pumping (8,500 cfs maximum monthly estimated in CALSIM for January and February) during the winter months with high Delta inflows. Table 2-15b gives the monthly cumulative distribution of CALSIM-simulated SWP Banks pumping for the second half of the period. The simulated pumping was a little higher during this 1963–2003 hydrologic sequence.

Table 2-15c gives the monthly cumulative distribution of the historical SWP Banks pumping for the 1968–2008 hydrologic sequence (most recent 41 years). Although SWP pumping began in 1968, the Banks Pumping Plant was not fully operational (with the last four units) until 1989. Comparison of the recent historical SWP pumping (1995–2008 period with E/I objectives) indicates that the summer maximum pumping in July–September generally has been very high, approaching the 6,680 cfs permitted capacity. The historical SWP Banks pumping was more than 6,000 cfs in July for nine of the last 14 years, was more than 6,000 cfs in August for nine of the last 14 years, and was more than 6,000 cfs in September for five of the last 14 years. The CALSIM-simulated SWP Banks pumping was at capacity during these summer (i.e., water transfer) months in about 50% of the years.

SAN LUIS RESERVOIR OPERATIONS

San Luis Dam and Reservoir, with a capacity of about 2 maf, is a pumped-storage reservoir used primarily to provide seasonal storage for both CVP and SWP water exported from the Delta. The CVP share of the San Luis Reservoir storage is 972 taf. The SWP share of the San Luis Reservoir storage is 1,067 taf.

Table 2-16a gives the CALSIM-simulated monthly cumulative distributions of SWP San Luis Reservoir storage for the 1922–2003 existing conditions. The SWP San Luis storage reaches the maximum annual storage in the month of February or March, and generally declines in April through September as SWP demands are satisfied during the summer. The SWP San Luis storage is filled in about 30% of the years by the end of December, in about 60% of the years by the end of January, and in about 80% of the years by the end of February. When SWP San Luis Reservoir is filled, pumping of Article 21 (interruptible) water for SWP contractors with available storage (groundwater or surface reservoir) is simulated.

Table 2-16b gives the CALSIM-simulated monthly cumulative distributions of CVP San Luis Reservoir storage for the 1922–2003 existing conditions. The CVP San Luis storage also reaches the maximum annual storage in the months of February or March, and generally declines in April through September as CVP demands are satisfied during the summer. The CVP San Luis storage is filled in about10% of the years by the end of January, in about 30% of the years by the end of February, and in about 60% of the years by the end of March.

Table 2-16c gives the CALSIM-simulated monthly cumulative distributions of combined SWP and CVP San Luis Reservoir storage for the 1922–2003 existing conditions. The San Luis Reservoir storage is full in about 50% of the years by the end of March.

Exhibit 2-16a shows the CALSIM-simulated annual SWP Banks pumping and SWP total deliveries for the 1922–2003 existing conditions. The SWP pumping is a little higher than the SWP deliveries because of aqueduct and San Luis Reservoir losses, and because some of the SWP pumping is wheeling water for CVP deliveries. The SWP pumping and SWP deliveries for the October–March period also are shown to illustrate the seasonal pattern of pumping, San Luis Reservoir storage, and deliveries. The October–March pumping ranged between 1,000 taf and 2,500 taf each year and was always greater than SWP deliveries in the same period. This additional SWP water was stored in SWP San Luis Reservoir.

Exhibit 2-16b shows the SWP San Luis Reservoir storage at the end of March (maximum) and end of September (carryover) for 1922–2003. The graphs use the same scale of 0 to 5,000 taf to illustrate the modest contribution of the SWP San Luis Reservoir storage for SWP deliveries. The San Luis Reservoir allows more than half of the annual SWP pumping to be delivered in the summer months of peak demand. The average CALSIM-simulated SWP San Luis Reservoir storage release between March and September was about 525 taf. This is somewhat less than the releases from SWP San Luis Reservoir in recent years because the CALSIM model is simulating more carryover storage (Article 56) for deliveries in January and February of the next water delivery year.

Exhibit 2-17a shows the CALSIM-simulated annual CVP Jones pumping and CVP total deliveries for the 1922–2003 existing conditions. The CVP pumping is a little less than CVP deliveries because of some SWP pumping (wheeling) water for CVP deliveries. The CVP pumping and CVP deliveries for the October–March period are shown to illustrate the seasonal pattern of pumping, San Luis Reservoir storage, and deliveries. The October–March CVP pumping ranged between 1,000 taf and 1,500 taf in most years, and pumping was about twice the CVP deliveries (average of 720 taf) in the same period. This additional CVP water was stored in CVP San Luis Reservoir.

Exhibit 2-17b shows the CVP San Luis Reservoir storage at the end of March (maximum) and end of September (carryover) for 1922–2003. The graphs use the same scale as the SWP graphs to illustrate the CVP pumping and delivery volumes relative to the larger SWP pumping and delivery volumes. The contribution of the CVP San Luis Reservoir storage to seasonal CVP deliveries is greater than for SWP deliveries. The San Luis Reservoir allows the majority (70%) of annual CVP pumping to be delivered in the summer months of peak demand. The average CALSIM-simulated CVP San Luis Reservoir storage release between March and September was about 660 taf.

The seasonal CVP and SWP water supply (pumped in October–March and delivered in April–September) provided by San Luis Reservoir is limited in about 50% of the years by the maximum San Luis Reservoir storage capacity of about 2,000 taf. The project would divert some additional water (within the E/I objective) in the months of December–March and store the water for later discharge for export pumping in July–November. Therefore, the proposed project would provide about the same water supply benefits as increasing the San Luis Reservoir capacity by 215 taf (10% of the San Luis Reservoir capacity).

The actual operations of the project each year will depend on the sequence of Delta inflow, CVP and SWP exports, and CVP and SWP water demands (i.e., allocation of maximum contract amounts). The IDSM was used to determine the monthly project operations for the CALSIM-simulated existing conditions for 1922–2003. The next section describes the IDSM results.

2.4.6 IDSM-Simulated Project Operations

The water supply evaluation using the IDSM spreadsheet model provides a quantitative approach for evaluating project operations—the project diversions to storage, the project discharges for export pumping and delivery to designated places of use or groundwater banks, and the release of project water for increased Delta outflow. The recharge and pumping operations of the groundwater banking facilities also are simulated. A summary and discussion of the IDSM results for the project operations are presented in this section. The simulated monthly outflow and export pumping changes caused by project operations are presented to evaluate the basic project water supply benefits (i.e., water supply yield). These results also are used to evaluate potential effects caused by the project diversions or discharges for increased SWP pumping in subsequent resource topic areas of this SEIS (e.g., water quality, fisheries).

The IDSM results are used to evaluate potential water supply changes for designated SWP contractors. The simulated changes in combined SWP and CVP monthly exports are shown in the tables and exhibits at the end of this chapter to document the flow changes that will be important for evaluating water quality and fisheries effects. The changes in annual SWP deliveries are used to evaluate potential SWP water supply changes.

Exhibit 2-18 depicts the CALSIM-simulated annual baseline CVP and SWP Delta exports and the IDSM-simulated project export pumping and releases for Delta outflow for 1922–2003. Overall, the IDSM results indicate the project would be able to increase the combined CVP and SWP exports and deliveries by about 96 taf/year. In addition, about 64 taf/yr would be released for Delta outflow in years when the project stored water could not be exported because of limited SWP pumping capacity. The IDSM results suggest that about 45% of the project water would be delivered directly to the places of use without groundwater storage. The remaining 55% of the project water would be stored for at least 1 additional year in the designated groundwater banks and subsequently delivered to the places of use.

The project storage water may be released to increase Delta outflow in the fall months when there was not enough available export pumping capacity for all of the project storage. The IDSM estimates some storage remaining in the fall would occur in about 50% of the years. The IDSM modeling disclosed that releasing the water for salinity and estuarine habitat improvements, and not carrying storage over to the successive water year would not substantially reduce the total export and delivery capability of the project because the probability of refilling the Reservoir Islands each year was comparatively high. Another advantage of releasing unused project storage water each year was to reduce the potential water quality degradation (i.e., increased EC and DOC) that may occur in the Reservoir Islands during a 2-year water storage period.

EXCESS DELTA OUTFLOW

Project diversions would occur only when there was surplus or excess Delta outflow. Project diversions would be allowed if the required Delta outflow was exceeded and the allowable E/I ratio was not exceeded with project diversions included as though they were increased exports.

Table 2-17a shows the CALSIM-simulated monthly distributions of Delta outflow for the 1922–2003 period. The average Delta outflow was about 15,000 taf. The simulated Delta outflow was often controlled by the required Delta outflow but may be higher if the E/I ratio is limiting exports, or if the inflow is greater than the maximum needed to supply full export pumping. Table 2-17b indicates that the simulated Delta outflow was higher during the second half of the hydrologic record, with an average outflow of about 17,000 taf for 1963–2003. This suggests that the average annual outflow during the first half of the hydrologic period was an average of about 1,300 taf. Table 2-17c compares the historical Delta outflow for the 1963–2003 period. The average annual historical Delta outflow was about 3,000 taf higher than the simulated outflow, most likely because the CALSIM inflows were slightly lower and the simulated CVP and SWP exports were higher.

Table 2-18a shows the IDSM-calculated monthly distribution of the required Delta outflow for the 1922–2003 period. There are D-1641 specified Delta outflow requirements for each year-type in the months of October–January and July–September. The X2 requirements vary in the months of February–June. Table 2-18b shows the IDSM-calculated “surplus” Delta outflow that is greater than the required Delta outflow and within the E/I ratio with the simulated monthly CVP and SWP exports. Some months have very high excess Delta outflow of more than 10,000 cfs. The median monthly excess outflow was more than 2,000 cfs for November–May. However, these excess Delta outflow calculations in April and May do not account for the export reductions in April and May for fish protection. Project diversions would not occur in April and May under the existing conditions. Therefore, the months with the highest occurrence of excess Delta outflow (within the E/I ratio) that could be diverted onto the project Reservoir Islands are November–March.

Exhibit 2-19 shows the CALSIM-simulated monthly Delta outflow for the recent 20-year period of 1984–2003. The D-1641 required Delta outflow for the period is shown in red. The dark blue color indicates the outflow that is above the required outflow but within the required E/I ratio for exports (and assumed to limit project diversions). The total simulated Delta outflow is shown in light blue. This graph indicates that in about half the years, the simulated Delta outflow would be more than 50,000 cfs for 1 or more months, and project diversions would be possible within the E/I ratio (dark blue shaded). In about 25% of the years, the Delta outflow would not exceed 50,000 cfs, but there would be at least 1 month of surplus Delta outflow within the E/I ratio to allow project diversions. In about 25% of the drier years, however, there would not be sufficient surplus Delta outflow to allow project diversions.

The Reservoir Islands would have a combined maximum diversion capacity of about 5,500 cfs (11 taf/day), so that the full available storage volume of about 215 taf could be diverted in 1 month, assuming the daily excess outflow (within the E/I ratio) remained greater than 5,500 cfs for at least 3 weeks during a month. Project diversions may be limited by other, more specific operational rules (FOC) to protect water quality and fish.

PROJECT DIVERSIONS TO RESERVOIR STORAGE

Table 2-19a shows the IDSM-simulated monthly distributions of the project diversions for storage for the 1922–2003 period. The Webb Tract and the Bacon Island diversions were simulated separately because these diversions may be subject to slightly different operating rules (FOC). The cumulative distribution of project diversions was highest in December and decreased in January, February, and March because the project storage islands were more likely to already be filled later in the diversion period. The simulated annual average project diversion volume was 168 taf. The project diversions were less than 28 taf in 20% of the years. There was not enough excess Delta outflow to fill the project storage islands in about 25% of the years. To summarize, the project had no diversions for 20% of the years, partial diversions for 10% of the years, and filled reservoirs for 70% of the years modeled.

Exhibit 2-20 shows the IDSM-simulated project diversions for the 1984–2003 period. The monthly Delta outflow with (green line) and without (blue line) the project diversions is shown for comparison. The project diversions were limited to the months of December–March when the Delta outflow was greater than 11,400 cfs to maintain X2 downstream of Chipps Island. Project diversions of about 4,000 cfs (215 taf) were simulated in about 16 of these 20 years. The change in Delta outflow can be identified for the months when project diversions were simulated. Project diversions were not simulated in four of these 20 years because there was not sufficient surplus Delta outflow within the E/I ratio in the months of December–March. For example, no project diversions were simulated in 1990 or 1994 because Delta outflow did not exceed 15,000 cfs. No project diversions were simulated in 1991 or 2001, although the Delta outflow was more than 15,000 cfs for at least one month, because the project diversions would have exceeded the E/I ratio. This graph indicates that there is usually (in 75% of the years) available surplus Delta outflow for project diversions.

PROJECT DISCHARGES FOR EXPORT

Table 2-19b shows the simulated monthly distributions of the project discharges for export for the 1922–2003 period. The Webb Tract and the Bacon Island discharges were simulated separately because these discharges for export may be subject to slightly different operating rules (FOC). The cumulative distribution of project discharges for export were highest in July and decreased in August and September, with some discharge for export in October and November. The simulated annual average volume of project discharges for export was 96 taf. Therefore, about 57% of the simulated average annual project diversions were exported in the July–November period. The project annual discharges for export were less than 10 taf in 30% of the years, and less than 83 taf in 50% of the years. A storage volume of at least 190 taf was discharged in about 20% of the years.

Exhibit 2-21 shows the monthly combined CVP and SWP export pumping for the 1984–2003 period. The monthly pumping (green bars) varied from about 2,000 cfs in a few months (e.g., April and May VAMP reductions) of dry years to more than 10,000 cfs in many winter and summer months. The exports may be limited by fish protection actions (i.e., VAMP and CVPIA b[2] reductions) or by the maximum E/I fraction of the Delta inflow. The SWP maximum permitted pumping may limit exports in some years. These possible export limits are indicated by the E/I ratio (gray line) and the maximum allowable pumping for fish protection (blue line with diamonds). When the blue diamonds are on the gray line, the E/I ratio is limiting exports. When the diamonds are below the E/I ratio (gray line), fish protection measures are limiting exports. The CALSIM-simulated export pumping is often less than the allowable pumping, indicating that outflow requirements were limiting exports, or that San Luis Reservoir was full.

Exhibit 2-21 also shows the IDSM-simulated project exports (red bar on top of the green bar), which were allowed in July–September whenever there was available export pumping capacity. The project exports were allowed to exceed the E/I ratio because the project stored water was diverted under the E/I criteria. The increased SWP pumping during the July–September period was considered a water transfer from within the Delta. The maximum project exports were assumed to be 4,000 cfs to allow full discharge within 1 month if there was available permitted pumping capacity. Project exports of at least 100 taf were simulated in 13 of the 20 years.

PROJECT RELEASES FOR OUTFLOW

Table 2-19c shows the simulated monthly distributions of the project releases for outflow for the 1922–2003 period. The Webb Tract and the Bacon Island releases for outflow were simulated separately because these releases for outflow may be subject to slightly different operating rules (FOC). The project releases for outflow were simulated in September and October to reduce the salinity at CCWD diversions (and at SWP and CVP export facilities) if the estimated chloride concentrations were greater than 125 mg/l. The changes in salinity caused by the release of 1,000 cfs from the project storage islands would be measurable upstream of Antioch (i.e., central and south Delta), and estuarine habitat conditions would be changed slightly between Chipps Island and Collinsville. Any remaining project storage water was assumed to be released in November, to reduce salinity and to reduce the accumulation of DOC concentrations (see also Section 3.11, “Hydrology and Water Quality”). Project releases for outflow were simulated in September and October for about 10% of the years and in November for about 30% of the years. The simulated annual average volume of project releases for outflow was 64 taf (about 38% of the average annual project diversions).

Exhibit 2-22 shows the IDSM-simulated project releases for outflow (red bars) for the 1984–2003 period. The project releases were simulated in September, October, and November when the project storage water could not be exported during the July–November period. Releases of 1,000 cfs were simulated if the estimated Rock Slough chloride concentration was greater than 125 mg/l in September or October. The remainder of project storage was released in November. An average of 64 taf/yr of project stored water was simulated to be released for Delta outflow. The actual releases would vary depending on the available water that could not be exported and the forecasted Delta conditions in these months. This release of water for increased Delta outflow is simulated as a beneficial use for improved fish and wildlife habitat in the estuary and is considered as a designated place of use for project water.

Exhibit 2-22 also indicates the reduction in chloride concentration resulting from the project storage releases for outflow that were simulated for the 1984–2003 period. Releases for outflow of more than 50 taf were simulated in eight of the 20 years. The improvement in chloride concentration depends on the Delta outflow during the release. If the chloride concentration was 250 mg/l (maximum D-1641 criteria), a release of 1,000 cfs would reduce the chloride concentration to about 150 mg/l. If the chloride concentration was 150 mg/l, a release of 1,000 cfs would reduce the chloride concentration to about 100 mg/l (see also Section 3.11, “Hydrology and Water Quality”).

Exhibit 2-23 shows the simulated changes in the X2 position caused by the project diversions in December–March and by the project releases for outflow in September–November. Project discharges for export pumping in July–November would not change the outflow or the X2 position. The project diversions will increase the X2 position by less than 1 km and were assumed to occur only when X2 would remain downstream of Chipps Island (75 km). The project releases of 1,000 cfs for outflow generally would move X2 downstream about 1 km if X2 was about 85 km upstream from the Golden Gate. Less of a downstream movement would occur if X2 was already farther downstream.

Exhibit 2-24 shows the IDSM-simulated project storage on Webb Tract and Bacon Island for the 1984–2003 period. As described above, the surplus Delta outflow was sufficient to allow project diversions in 16 of the 20 years. Bacon Island was assumed to be filled first, so there were small diversions to Bacon in a few more years. Discharges in July–November were for export pumping and direct delivery to CVP and SWP contractors or storage in the groundwater banks for subsequent delivery to SWP contractors. project storage water was assumed to be released for Delta outflow in September–November, if the water was not discharged for exports in the July–November period. Actual project operations in these months with both discharges for exports and releases for outflow would depend on forecasted SWP pumping capacity.

Exhibit 2-25 shows the IDSM-simulated project operations, indicated by the Bacon Island and Webb Tract diversions and discharges for export or for outflow for the 1984–2003 period. The IDSM results indicate that the project would operate in more than 75% of the years.

DELIVERY OF PROJECT WATER

The amount of project water delivered to designated SWP contractors each year would depend on the water delivery allocations for each contractor within the designated places of use for the project water. The IDSM simulation of project exports is calculated by considering the simulated SWP water demand deficits, the available pumping capacity, the aqueduct capacity, and the recharge capacity of the groundwater banks. The selected fraction of the demand deficits that can be supplied to the project designated places of use (50% SWP, 0% CVP) was adequate to allow a majority (57%) of the project storage water to be exported. This fraction could be increased by allowing a greater fraction of the SWP demand deficits to be met with project water (increased designated places of use) or by increasing the permitted SWP summer pumping capacity of 6,680 cfs.

Table 2-20a gives the IDSM-simulated monthly distributions of project water that was exported for direct delivery to designated places of use using 50% of the SWP contractor unmet demands (i.e., delivery deficits) as a proxy for the designated place of use unmet demands. All designated places of use can be supplied with project water directly using SWP conveyance facilities. Metropolitan is a SWP contractor. Two places of use, Semitropic and Western, are member agencies of SWP contractors. There are no CVP contractors designated for project delivery at this time. The direct SWP contractor deliveries occur in the months of July–November, which include the peak demand months for agricultural and municipal contractors. The average IDSM-simulated SWP direct deliveries from project storage water were about 43 taf. The actual export and delivery pattern would vary each year according to the delivery deficits for the designated places of use, and the forecasted SWP pumping (i.e., unused permitted capacity).

Table 2-20b gives the IDSM-simulated monthly distributions of project water that was delivered (i.e., pumped) from the designated groundwater banks. The delivery of groundwater was simulated in the months of May through November. The groundwater banks can deliver water directly to SWP contractors only because the groundwater banks are located south of the CVP service areas. Deliveries from the groundwater banks were simulated in about 20% of the years. The average annual simulated delivery of project water pumped from the groundwater banks was about 53 taf/yr.

Exhibit 2-26 shows the CALSIM-simulated monthly delivery to CVP contractors (green bars) for the 1984–2003 period. The CVP deliveries are almost always less than the full contractor demands (blue diamonds), so additional delivery from project storage might be possible in some years. This increased CVP delivery often would require pumping at the SWP Banks Pumping Plant (i.e., wheeling), and may be limited by available SWP permitted pumping capacity. There are no CVP contractors in the designated places of use for project water at this time. Temporary water transfer approvals or changes in the designated places of use would be required for future delivery to CVP contractors.

Exhibit 2-27 shows the CALSIM-simulated monthly delivery to SWP contractors (green bars) and the IDSM-simulated delivery of project storage water to SWP contractors (red bars) for the 1984–2003 period. The SWP deliveries were sometimes enough for full contract (Table A) deliveries, but often were less than the full contractor demands, so additional delivery from project storage was possible in many years. Some of these SWP deliveries were made after storage in the groundwater banks for 1 or more years. SWP deliveries were simulated in about 13 of the 20 years.

STORAGE OF PROJECT WATER IN GROUNDWATER BANKS

Table 2-21a gives the IDSM-simulated monthly distribution of project water that was exported and stored in the designated groundwater banks for 1922–2003. The groundwater recharge would occur in the months of project exports when direct delivery to designated SWP contractors was not needed. The IDSM-simulated average annual volume of project storage that was exported at the SWP pumps and recharged to the groundwater banks in July–November was about 53 taf. Table 2-21b gives the IDSM-simulated monthly distribution of groundwater bank storage for 1922–2003. Groundwater storage was used for project water in about 30% of the years.

The amount of project water that can be exported to the groundwater banks in wet years depends on the available export capacity in the July–November water transfer period not already used by CVP and SWP pumping. In wet years when CVP and SWP are delivering most of the water demands, the pumping already may be at permitted capacity. The available summer pumping could be increased in the future by the State Water Board and the Corps raising the permitted SWP pumping capacity of 6,680 cfs to 8,500 cfs or 10,300 cfs (physical capacity) for at least the summer water transfer period of July–September. This higher summer pumping would allow more CVP and SWP water to be exported and delivered during peak summer demands and would facilitate project water exports, as well as other water transfers from upstream.

These simulated results demonstrate the importance of the Semitropic and Antelope Valley groundwater banks for allowing more of the project storage water to be exported and delivered to designated places of use in more years than would be possible with only direct deliveries. There are several dry years (25%) with no project diversions to storage and therefore no direct project deliveries. There are several other years when project diversions to storage were possible, but there was no unused export pumping capacity in the summer or fall months for project deliveries. project storage water that could be exported in the summer or fall months in wet years when SWP water deliveries were high can be stored again in the designated groundwater banks. The project yield therefore is increased substantially with the designated groundwater banks. The IDSM simulations indicate that the water supply delivery (i.e., yield) was increased by 53 taf/yr, from 43 taf/yr to 96 taf/yr, with the groundwater banks.

Exhibit 2-28 shows the IDSM-simulated groundwater bank storage for the 1984–2003 period. The groundwater banks were used in about half of the years, and this water then was pumped to SWP contractors in the next water year with a demand deficit. The actual operation of the groundwater banks might be different from the relatively simple monthly operations simulated with IDSM and would depend on the needs of the designated SWP contractors.

EFFECTS OF PROJECT OPERATIONS

The IDSM-simulated monthly project operations are adequate for evaluating the likely effects on Delta flows, Delta salinity, fish entrainment, and estuarine habitat conditions.

These CALSIM-simulated monthly Delta flows are representative of the future monthly CVP and SWP operations (No-Action Alternative) that will govern project diversions, exports, and deliveries. The IDSM-simulated monthly project operations are accurately calculated and adequate to describe the likely project water supply benefits (for contractor delivery to designated places of use and for Delta outflow augmentation) and to allow the nature and magnitude of water quality and fishery impacts to be determined and evaluated.

There will be variations from the monthly rules used to control the IDSM simulations in the actual daily project operations. The actual project operations will be governed by the revised D-1643 FOC, revised project BOs, and the WQMP requirements. There will be some differences between monthly flows and daily flows; these were generally explored and described in Appendix A4 of the 1995 DEIR/EIS (incorporated by reference herein). These were also evaluated in the DWR in-Delta storage investigations, which used daily modeling of Delta flows and in-Delta storage operations (a list of these reports is provided below in Table 2-4). However, monthly operations are generally adequate for characterizing water quality and fish impacts, as shown in Appendix A4 to the 1995 DEIR/EIS.

2.4.7 Simulated Project Operations for Water Year 1980–2003

The project operations would depend on the simulated monthly sequence of Delta inflow, Delta exports, and Delta outflow. The CALSIM-simulated monthly flows for the 24-year period of 1980–2003, along with the simulated project operations, would be shown as an example of the Delta flows and project operations with the corresponding changes in Delta flows. The range of monthly Delta inflows for this 24-year period was similar to the 82-year range of monthly inflows for the full 1922–2003 CALSIM period. Therefore, this 24-year sequence allows most of the variations in potential project operations to be described and evaluated. These most recent 24 years of the CALSIM and IDSM simulation period also will be used for describing the simulated water quality and fish effects of the project operations.

Table 2-22 gives the CALSIM-simulated monthly total Delta inflow for 1980–2003. The monthly total Delta inflows (cfs) are given in water year by month format. The annual inflow volumes (taf) are given in the right-hand column. The average annual total Delta inflow volume for 1980–2003 was 25,112 taf, which was considerably higher (15%) than the 1922–2003 average of 21,918 taf because the 1982 and 1983 inflows were exceptionally high.

Table 2-23 gives the CALSIM-simulated monthly combined Delta exports for 1980–2003. The monthly combined Delta exports (cfs) are given in water year by month format. The annual combined export volumes (taf) are given in the right-hand column. The average annual combined Delta export volume for 1980–2003 was 5,882 taf, very similar to the 1922–2003 average annual combined Delta export volume of 5,939 taf.

Table 2-24 gives the CALSIM-simulated monthly Delta outflows for 1980–2003. The annual Delta outflow volumes (taf) are given in the right-hand column. The average annual Delta outflow volume for 1984–2003 was 18,207 taf, considerably higher (20%) than the 1922–2003 average annual Delta outflow volume of 14,878 taf.

Tables 2-25 (Alternative 2), 2-31 (Alternative 1) and 2-36 (Alternative 3) give the IDSM-simulated monthly project diversions to storage for 1980–2003. The project diversions would reduce the Delta outflow by the same amount. The simulated project diversions in December–March were always limited to outflows greater than 11,400 cfs because the simulated project operating criteria specify that X2 must be downstream of Chipps Island.

Tables 2-26 (Alternative 2), 2-32 (Alternative 1) and 2-37 (Alternative 3) give the IDSM-simulated monthly project discharges for export for 1980–2003. The project discharges for export would increase SWP exports by the same amount. The simulated project discharges in July–November generally were between 1,000 cfs and 2,000 cfs, and were always less than the specified maximum discharge of 4,000 cfs. The project discharges usually were distributed over several months, including the 3-month water transfer window identified in the OCAP BOs (July–September), to facilitate delivery to the designated places of use or groundwater banks. The Delta outflow would not be changed by project discharges for export.

Tables 2-27 (Alternative 2), 2-33 (Alternative 1) and 2-38 (Alternative 3) give the IDSM-simulated monthly project releases for outflow for 1980–2003. The project releases for outflow would increase Delta outflow by the same amount. The simulated project releases in September and October were always less than the specified maximum release for salinity control of 1,000 cfs. Some of the November releases were higher because all remaining project storage was assumed to be released in November. Releases in November also would reduce salinity in December

Table 2-4
California Department of Water Resources Reports for the CALFED Bay-Delta Program Integrated Storage Investigations Program

2001 Reports

- Evaluation of Delta Wetlands Proposed Fish Screens, Siphons and Pumping Stations—Draft Report. December 2001. (Prepared by URS Corporation and CH2M Hill for DWR) (California Department of Water Resources 2001)
- In-Delta Storage Program Risk Analysis—Final Draft Report. December 2001. (Prepared by URS Corporation) (U.S. Bureau of Reclamation and DWR 2001)

2002 In-Delta Storage Program Reports

- Draft Report on Economic Analysis. May 2002. (California Department of Water Resources 2002a)
- Draft Report on Operation Studies. May 2002. (California Department of Water Resources 2002b)
- Draft Report on Water Quality Investigations. May 2002. (California Department of Water Resources 2002c)
- Synthesis of Data for Development of Reservoir Island Organic Carbon Model in DSM2—Technical Report. May 2002. (Prepared by Marvin Jung for DWR) (California Department of Water Resources 2002d)
- Draft Water Quality Modeling Technical Appendix. May 2002. (California Department of Water Resources 2002e)
- Draft Report on Environmental Evaluations. May 2002. (California Department of Water Resources 2002f)

2003 In-Delta Storage Program State Feasibility Study Reports

- Results of Geologic Exploration Program. January 2003. (California Department of Water Resources 2003a)
- Results of Laboratory Testing-Geologic. January 2003. (California Department of Water Resources 2003b)
- Borrow Area Geotechnical Report—Draft. April 2003. (Prepared by URS for DWR) (California Department of Water Resources 2003c)
- Integrated Facility Structures Construction Cost Estimate—Draft Report. June 2003. (Prepared by CH2M Hill for DWR) (California Department of Water Resources 2003d)
- Flooding Analysis—Draft Report. June 2003. (Prepared by URS for DWR) (California Department of Water Resources 2003e)
- Embankment Design Analysis—Draft Report. June 2003. (Prepared by URS for DWR) (California Department of Water Resources 2003f)
- Earthwork Construction Cost Estimate —Draft Report. June 2003. (Prepared by URS for DWR) (California Department of Water Resources 2003g)
- Risk Analysis. June 2003. (Prepared by URS for DWR) (California Department of Water Resources 2003h)
- Integrated Facilities Engineering Design and Analysis—Draft. July 2003. (California Department of Water Resources 2003i)
- Draft Environmental Evaluations. July 2003. (California Department of Water Resources 2003j)
- Reservoir Stratification Study—Final Report. July 23, 2003. (Prepared by Flow Science Incorporated for DWR) (California Department of Water Resources 2003k)
- Draft Engineering Investigations. July 2003. (California Department of Water Resources 2003l)
- Draft Report on Operations. December 2003. (California Department of Water Resources 2003m)
- Draft Report on Water Quality. December 2003. (California Department of Water Resources 2003n)

2004 In-Delta Storage Program State Feasibility Study Reports

- Draft Summary Report. January 2004. (California Department of Water Resources 2004a)
- California Bay-Delta Authority In-Delta Storage Program State Feasibility Study—Public Comment Letters (California Department of Water Resources 2004b)
- Draft Report on Economic Analysis. January 2004. (California Department of Water Resources 2004c)
- Draft Executive Summary. January 2004. (California Department of Water Resources 2004d)
- Piezometer Installation Report. July 2004. (Prepared by Lowney Associates for DWR) (California Department of Water Resources 2004e)

Table 2-4 **California Department of Water Resources Reports for the CALFED Bay-Delta Program Integrated Storage Investigations Program**
2005 In-Delta Storage Program State Feasibility Study Reports
▸ Review of Delta Wetlands Water Quality: Release and Generation of Dissolved Organic Carbon from Flooded Peatlands—Final Report. (Prepared by K. Reddy for DWR) (California Department of Water Resources 2005a) ▸ Proposed Integrated Facility at Webb Tract Supplemental Geotechnical Exploration—Draft Report. April 2005. (Prepared by URS for DWR) (California Department of Water Resources 2005b) ▸ Groundwater Monitoring Jones Tract Flood Sacramento-San Joaquin Delta, California. April 2005. (Prepared by Hultgren-Tillis Engineers for DWR) (California Department of Water Resources 2005c) ▸ Risk Analysis—Draft Report. May 2005. (Prepared by URS for DWR) (California Department of Water Resources 2005d) ▸ Integrated Facilities Supplemental Structural Engineering Design and Analysis—Draft Report. May 2005. (Prepared by URS for DWR) (California Department of Water Resources 2005e)
2006 In-Delta Storage Program State Feasibility Study Reports
▸ 2006 Supplemental Report to 2004 Draft State Feasibility Study In-Delta Storage project. May 2006. (California Department of Water Resources 2006)
Source: ICF 2010: 2-21 and 2-22; adapted by AECOM in 2013

and January if the Delta outflow remained relatively low. Project releases for salinity were made in about 10% of the years and for outflow (including salinity releases and discharges to empty reservoirs) for 30% of the years. There is not a specific commitment to release a certain amount of water in the fall for outflow regardless of export diversions above that amount that needs to be released to meet salinity requirements and to empty the reservoirs every year.

Table 2-28 gives the CALSIM-simulated end-of-month X2 position (kilometers) for the existing conditions (without project operations) for 1980–2003. Project diversions would increase X2 (upstream movement), and project releases for outflow would reduce X2 (downstream movement). Project discharges for export in July–November would not change the X2 location. Tables 2-29 (Alternative 2), 2-34 (Alternative 1) and 2-39 (Alternative 3) give the IDSM-simulated end-of-month X2 position (kilometers) with project operations for 1980–2003. Tables 2-30 (Alternative 2), 2-35 (Alternative 1) and 2-40 (Alternative 3) give the monthly changes in calculated X2 caused by project operations. The effects of project operations on the simulated X2 location can persist for 1 or 2 months after the diversion to storage or the release for outflow because of the “moving average” effects of Delta outflow on X2. Comparing Table 2-25 (project diversions) with Table 2-30, it can be seen that project diversions in December–March often change (increase) X2 for 2 or 3 months. Project releases for outflow in September, October, and November can be seen to change (reduce) the X2 position for more than 1 month.

The IDSM-simulated project operations shown in these water-year-by-month tables for 1984–2003 will be used to describe and evaluate changes in Delta water quality and fish effects from estuarine habitat changes or entrainment of larvae, juveniles, or adult fish and zooplankton (fish food).

2.5 NEW INFORMATION AND CHANGED CIRCUMSTANCES

The Delta ecosystem (e.g., habitat, species abundance), infrastructure (e.g., levees, conveyance), land use (e.g., agricultural, urban development), and water management operations (e.g., outflow, exports) remain the focus of many ongoing studies, evaluations, and planning efforts. Some of these have provided new information directly relevant to the project design, and are discussed here; others are reviewed in the appropriate topic-specific analysis in Chapter 3.

2.5.1 CALIFORNIA DEPARTMENT OF WATER RESOURCES IN-DELTA STORAGE OPERATIONS STUDIES

DWR conducted several operations studies for the CALFED Bay-Delta Program Integrated Storage Investigations Program (ISI) (see Table 2-4). DWR assumed that Bacon Island and Webb Tract would be operated as described in SWRCB Decision D-1643 FOC and the project BOs. DWR developed a daily operations model for Delta flows and in-Delta storage, as was described in Appendix A4 of the 1995 DEIR/EIS. The major difference in the DWR studies was that the in-Delta storage was operated as a new SWP facility, integrated with upstream storage and Delta operations to help meet full SWP Table A demands. For reference, the average export pumping simulated for the 1922–1994 (73-year) period with CALSIM was 6,030 taf/yr. The integrated operations generally allowed the in-Delta storage to provide a water supply benefit (i.e., average yield) of about 125 taf/yr.

Table 2-4 lists the individual studies that were completed for the in-Delta storage investigations. These technical reviews and draft reports represent several thousand pages describing and evaluating the in-Delta storage project, essentially the same as the project described in this SEIS. Only the general findings as summarized in the last report of the series in 2006 are reviewed in Table 2-4.

DWR operations studies generally confirmed the results from the 1995 DEIR/EIS and the 2000 RDEIR/EIS, suggesting that the in-Delta storage would be filled in approximately 75 percent of the years, and this water would be able to be exported in many years with a delivery deficit. The DWR studies allowed water to remain in storage if there was not sufficient excess pumping capacity or unmet water demand in a given year. The DWR studies did not need to identify specific SWP contractors as the place of use because the SWP operates to supply all contractors equally. Their water rights already include all contractors as the place of use.

The DWR studies evaluated many different types of operations and delivery targets, including several that would increase Delta outflow at times for water quality (salinity control), and for Environmental Water Account (EWA) purposes to make up for reduced export pumping for fish protection. The use of the stored water easily could be shifted from year to year as conditions changed, but the general ability to capture the full in-Delta storage volume in approximately 75 percent of the years was confirmed.

DWR found that in-Delta storage would allow several short-term SWP and CVP reoperation improvements. Upstream reservoir releases that were made for upstream fisheries benefits that were greater than exports and required outflow could be temporarily stored in the in-Delta reservoirs and then exported when conditions allowed. These integrated operations may increase the potential value of in-Delta storage, but are not evaluated in this SEIS. The Delta Wetlands project is proposed as a stand-alone project and would not be integrated into the SWP.

DWR evaluated several different assumptions about dissolved organic carbon (DOC) release rates, and the allowed discharge rates depending on the in-Delta storage DOC concentrations. These operations are reviewed in Section 3.11, "Hydrology and Water Quality."

2.5.2 PUBLIC POLICY INSTITUTE OF CALIFORNIA REPORTS

Since the 2001 FEIS was prepared, the Public Policy Institute of California (PPIC) has issued two reports that compile and address new information relevant to the Delta and the project description. *Envisioning Futures for the Sacramento–San Joaquin Delta*, released in February 2007 (Lund et al. 2007), and *Comparing Futures for the Sacramento–San Joaquin Delta*, released in July 2008 (Public Policy Institute of California 2008), suggest that many changes in the Delta are inevitable because of seismic risk, peat-soil subsidence and sea-level rise, hydrology changes from climate change, urban development, and ecosystem dynamics (e.g., new species of fish and invertebrates and plankton). They suggest that planning to accommodate these future changes should be a state priority. In the first report, a wide range of alternatives is described. However, in the second report, PPIC concludes that a peripheral canal is likely the best long-term solution for water supply reliability and ecosystem stability.

Envisioning Futures for the Sacramento–San Joaquin Delta examines nine Delta alternatives, concluding that only five should be considered economically and environmentally feasible: three “Fluctuating Delta” alternatives, in which environmental conditions, especially salinity, would be allowed to fluctuate in the western Delta to improve habitat conditions for native fish species; and two “Reduced-Exports” alternatives, which would necessitate significant modification of the pattern and quantity of Delta water exports. One such Reduced Export model, titled “Opportunistic Delta,” allows opportunistic seasonal exports during times of high discharge of fresh water from the Delta (generally winter and spring) and the building of additional surface storage within the Delta to divert and store water during these periods of high outflow.

Both PPIC Delta reports acknowledge that in-Delta storage may be one of the future uses for the relatively deep central Delta islands. They suggest that levee maintenance and repair costs exceed the benefits of the existing agricultural uses. Both PPIC reports and their extensive technical appendices are available from the following website: <http://www.ppic.org/main/home.asp>.

2.5.3 Delta Vision and Strategic Plan

The Delta Vision policy initiative was created by former Governor Arnold Schwarzenegger in September 2006, to find a durable vision and strategic plan for sustainable management of the Delta. Delta Vision is designed to coordinate and build on the many ongoing but separate Delta planning efforts, while assessing the risks and consequences to the Delta’s many uses and resources in light of changing climatic, hydrologic, environmental, seismic, and land use conditions. Ultimately, Delta Vision seeks sustainable management of the Delta over the long term, broadening the focus of past Delta efforts to recommend actions that will address the full array of natural resource, infrastructure, land use, recreation, and governance issues necessary to achieve a sustainable Delta.

The California Blue Ribbon Task Force was appointed by the Governor in February 2007 and charged with the goal of:

> ...managing the Delta over the long term to restore and maintain identified functions and values that are determined to be important to the environmental quality of the Delta and the economic and social well being of the people of the state.

The Task Force issued its report, *Delta Vision: Our Vision for the California Delta*, in December 2007, recommending, in small part, that new storage facilities for surface water or groundwater should capture water when and where it would be least damaging to the environment. A stakeholder group also was appointed by the Governor to provide input and feedback to the task force. The task force produced the *Final Delta Vision Strategic Plan* in October 2008, which includes seven major goals with 22 basic strategies, and several recommendations for accomplishing each strategy and goal. In-Delta storage was fully described in some of the stakeholder group’s suggested strategies and was identified as a possible component of the future Delta in the vision document. However, no specific new information about Delta conditions or changes that would affect the project description was given in either of these documents. The Delta Vision process and documents are thoroughly documented on the following website: <http://deltavision.ca.gov>.

2.5.4 Delta Water Legislative Package

As a result of the Delta Vision process, California lawmakers passed a package of legislation addressing many of California’s water supply-related challenges. Among the bills in the package was Senate Bill (SB) 1, designed to carry out the Delta Vision strategic plan, and to legally acknowledge the co-equal goals of restoring the Delta ecosystem and creating a more reliable water supply for California.

SB 1 created new policies, programs and governance for the Delta. Among its primary elements was creation of the Delta Stewardship Council, which is tasked with developing and implementing the Delta Plan to guide state and local actions in the Delta. SB 1 also gives the Delta Stewardship Council jurisdiction to review state or local agencies' projects in the Delta to determine consistency with the Delta Plan. The Council also acts as the appellate body in the event of a claim that such a project is inconsistent with the co-equal goals. The Delta Water legislative package, and extensive Delta Stewardship Council information, are available on the following website: <http://deltacouncil.ca.gov>.

2.5.5 SACRAMENTO-SAN JOAQUIN DELTA FLOW CRITERIA

On August 3, 2010, SWRCB issued a report entitled *Development of Flow Criteria for the Sacramento-San Joaquin Delta Ecosystem* (Flow Criteria Report) as required by the Sacramento-San Joaquin Delta Reform Act of 2009. The Flow Criteria Report contains both numeric flow criteria and non-numeric flow criteria. The Flow Criteria Report also contains numeric criteria goals as well as narrative biological and management goals.

The Flow Criteria Report clearly states that none of the determinations therein have regulatory or adjudicatory effect and that the report is for informational purposes only (State Water Resources Control Board 2010: 3). Further, the Flow Criteria Report states that it is not the intent of the SWRCB "that these criteria be interpreted as precise flow requirements for fish under current conditions" (State Water Resources Control Board 2010: 5). If and when SWRCB develops Delta flow objectives with regulatory effect it may consider the Flow Criteria Report; however, SWRCB must also "ensure the reasonable protection of beneficial uses, which may entail balancing of competing beneficial uses of water, including municipal and industrial uses, agricultural uses, and other environmental uses… [and] an analysis of the economic impacts that result from changed flow objectives" (State Water Resource Control Board 2010: 3). SWRCB has continuing jurisdiction over water right permits and licenses and may impose further limitations to protect public trust uses or meet future flow objectives. (Id.) Therefore, the Flow Criteria Report does not have any present regulatory effect, and water rights issued now for the project could be adjusted by SWRCB in the future to meet any Delta flow objectives that do have regulatory effect.

2.5.6 FUTURE CIRCUMSTANCES IN THE DELTA

Each of these recent or ongoing Delta planning studies (PPIC, Delta Vision, BDCP, and Delta Plan) has suggested that changes should be expected in the Delta ecosystem, infrastructure, and water supply operations. The project generally fits into this future Delta with a variety of contributions. The project would dramatically increase the managed wetlands, riparian, and upland vegetated habitats and dedicate much of the existing agriculture lands on Bouldin Island and Holland Tract to wildlife-friendly (i.e., partial harvest) agricultural production and wetlands habitat.

The levee maintenance on the Habitat Islands and strengthening of the interior portions of the Reservoir Island levees would reduce the risk of failure on these 56 miles of levees. In most years, the diversion and storage of water would increase the water supply by a substantial amount (about 100 taf) without major environmental impacts from the screened diversions and summer-fall export pumping.

The project would have the potential to contribute multiple benefits for the Delta environment, water quality, and water supply, regardless of what future Delta conditions may be implemented. However, the possibility that the project could become part of the CVP/SWP facilities with integrated operations is not proposed as part of the project and is not described or evaluated. This SEIS evaluates the project only as an independent facility with no effects or interference with the CVP and SWP operations, with the exception of any water that is exported through CVP and SWP facilities. In addition, the project would not interfere with restoration goals presented in BDCP/California Eco-Restore, because it would restore habitat types and geographies not targeted by those programs (i.e., subsided islands in the Central Delta).

2.5.7 2008 MITIGATION RULE

On March 31, 2008, EPA and USACE issued revised regulations governing compensatory mitigation for authorized impacts to wetlands, streams, and other waters of the U.S. under Section 404 of the Clean Water Act (2008 Mitigation Rule). These regulations are designed to improve the effectiveness of compensatory mitigation to replace lost aquatic resource functions and area, expand public participation in compensatory mitigation decision making, and increase the efficiency and predictability of the mitigation project review process.

As described previously, Alternatives 1 and 2 include implementation of a CMP that was prepared to meet the requirements of the 2008 Mitigation Rule. Under these alternatives, the project would substantially increase the amount of potentially jurisdictional wetlands in the Delta, including seasonal wetlands, riparian, and freshwater marsh.

2.5.8 REVISED TOTAL MAXIMUM DAILY LOAD FOR METHYLMERCURY

Section 303(d) of the CWA established the total maximum daily load (TMDL) process to guide the application of State water quality standards. In 2011, the Central Valley Regional Water Quality Control Board (Central Valley RWQCB) adopted the Delta methylmercury (MeHg) TMDL, which includes biological and water column objectives (Central Valley Regional Water Quality Control Board 2011b). California is also in the process of developing a methylmercury TMDL for reservoirs across the state, which includes consideration of aerial deposition of mercury in driving methylmercury levels.

In order to attain the TMDL goal, allocations have been assigned to the various sources of methylmercury in the Delta. The project islands are mostly in the central Delta region. The methylmercury load allocation for the central Delta is to maintain the current estimated level of 37 grams per year (g/yr) for agricultural sources plus 210 g/yr for wetland sources and 370 g/yr for open water (Central Valley RWQCB 2011b:Table A). (See Section 3.11, “Hydrology and Water Quality” for additional discussion.)

2.5.9 CALIFORNIA WATER PLAN/CALIFORNIA WATER ACTION PLAN

The California Water Plan is a broad-based planning effort, for which DWR last issued a “final” update in 2009. The project is addressed in the Chapter 12 of the 2009 update, where it is identified as the In Delta Storage Project (IDSP). The project is consistent with many of the broad objectives of the California Water Plan, including contributing to regional conjunctive (i.e., integrated groundwater and surface supply) water management. The project also supports the co-equal goals for the Delta.

The California Water Action Plan is a conceptual planning document that was released in January 2014 by the Governor’s Office. The project is consistent with many of the broad objectives of the California Water Action Plan, including the following “Actions:”

- Achieve the co-equal goals for the Delta;
- Protect and restore important ecosystems;
- Manage and prepare for dry periods;
- Expand water storage capacity and improve groundwater management;
- Increase operational and regulatory efficiency; and
- Identify sustainable and integrated financing opportunities.

Table 2-5
Monthly Cumulative Distribution of CALSIM-Simulated Sacramento River Flow (cfs) at Freeport for 1922–2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Annual taf
A. CALSIM-Simulated Sacramento River flow at Hood (cfs) for 1922–2003 (82 years)													
Min	7,590	7,082	6,703	6,155	7,904	7,384	7,678	5,365	8,792	10,113	7,676	7,451	6,252
10%	8,122	8,463	9,500	12,157	13,966	11,803	10,389	7,998	11,684	13,579	9,260	8,274	8,923
20%	9,300	9,524	12,513	13,168	15,897	16,068	11,422	11,619	13,205	15,740	11,776	9,434	10,433
30%	9,920	10,682	13,720	16,342	22,532	20,040	12,393	12,207	14,896	17,209	12,846	11,016	11,503
40%	10,723	11,563	14,741	19,447	26,172	22,358	14,522	13,280	15,767	18,465	13,601	11,856	12,666
50%	11,720	12,446	16,785	25,535	33,171	27,120	16,568	14,064	16,140	19,163	14,771	12,511	13,931
60%	12,380	13,184	18,018	32,093	46,418	33,075	20,405	16,456	17,168	20,018	15,298	13,528	18,201
70%	13,394	14,567	25,093	44,904	55,328	42,703	23,812	21,978	18,246	21,141	15,828	14,254	19,672
80%	14,044	15,979	34,880	57,196	69,098	56,924	36,295	28,020	20,020	22,126	16,305	16,870	22,006
90%	15,668	24,551	61,635	73,080	74,107	70,100	55,058	42,133	25,865	23,392	16,709	19,826	26,053
Max	36,228	64,087	75,281	78,752	78,781	77,204	74,616	66,494	63,393	24,535	20,692	26,648	34,969
Avg	12,149	15,010	25,147	33,725	39,591	34,311	23,863	20,159	18,431	18,773	14,036	13,325	16,201
B. Simulated for 1963–2003 (41 years)													
Min	7,733	7,099	6,703	6,155	7,904	7,384	8,743	5,365	8,792	10,113	8,063	7,451	6,252
10%	8,042	9,078	11,215	13,131	12,513	12,824	11,108	8,499	11,978	14,336	9,607	8,234	8,936
20%	9,534	10,459	13,675	16,278	18,387	18,712	12,118	10,368	13,785	17,054	12,561	9,385	10,580
30%	10,125	11,069	14,680	19,081	22,822	22,684	12,492	12,020	15,267	17,869	13,436	11,166	12,199
40%	11,372	12,473	15,612	25,119	27,625	27,208	15,799	13,301	15,841	19,117	14,841	11,787	13,884
50%	11,745	13,000	17,044	32,558	33,691	32,754	16,720	14,021	16,731	19,710	15,263	12,976	18,345
60%	12,203	14,519	21,939	45,875	50,310	39,805	20,986	16,258	17,921	20,554	15,536	13,797	19,279
70%	13,550	15,395	27,908	55,939	60,096	49,012	24,319	22,981	18,381	21,388	15,979	14,528	21,159
80%	14,323	19,139	35,540	70,657	71,693	59,473	35,588	28,319	20,839	22,705	16,627	18,418	22,112
90%	16,484	29,701	66,114	74,168	74,171	70,240	50,308	42,863	25,947	23,672	16,836	21,043	26,858
Max	36,228	64,087	75,281	78,752	78,781	77,204	74,616	66,494	63,393	24,279	20,692	26,648	34,969
Avg	12,654	17,069	27,359	39,172	41,635	38,036	24,671	20,515	19,500	19,388	14,458	13,878	17,396

Table 2-5
Monthly Cumulative Distribution of CALSIM-Simulated Sacramento River Flow (cfs) at Freeport for 1922–2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Annual taf
C. Historical for 1963–2003 (41 years)													
Min	4,494	6,380	7,743	8,984	8,003	6,573	5,961	6,414	6,865	8,248	7,687	6,838	5,505
10%	8,255	7,823	12,388	13,171	12,772	14,310	11,826	9,060	9,583	11,622	12,145	10,949	9,667
20%	9,398	10,872	13,671	17,190	18,271	21,316	12,724	10,974	10,729	12,142	13,219	12,360	10,978
30%	9,891	12,283	16,371	19,432	22,117	23,677	14,477	12,963	11,787	14,216	13,839	13,243	12,261
40%	11,684	12,680	20,319	23,190	31,196	24,510	16,887	13,799	12,660	15,000	14,916	14,567	13,395
50%	12,577	14,593	22,010	32,868	39,779	30,481	21,273	15,406	13,889	16,035	15,658	15,827	18,310
60%	13,942	15,500	25,545	38,277	48,596	43,374	25,827	19,735	16,017	17,726	17,020	16,463	19,968
70%	15,261	18,597	29,130	51,784	56,089	50,942	35,983	29,177	17,813	19,490	18,345	17,693	20,787
80%	16,077	22,250	36,558	56,803	62,372	56,235	43,213	40,113	23,710	20,848	19,497	18,573	22,620
90%	19,174	26,280	58,419	64,610	68,893	63,829	60,510	42,784	30,473	22,242	21,303	24,393	27,827
Max	28,688	48,820	74,513	87,110	81,368	78,290	76,580	63,181	55,690	31,000	25,177	25,317	34,096
Avg	13,097	17,016	27,669	36,297	40,629	37,204	28,124	22,806	18,275	16,925	16,236	16,132	17,521

Notes:

CFS = Cubic feet per second; taf = thousand acre feet; CVP = Central Valley Project; SWP = State Water Project

Source: ICF 2010:3-33 and 3-34; adapted by AECOM in 2013

Table 2-6
Monthly Cumulative Distribution of CALSIM-Simulated Yolo Bypass Flow (cfs) for 1922–2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Annual taf
A. CALSIM-Simulated for 1922–2003 (82 years)													
Min	0	0	0	0	0	0	39	24	52	41	41	19	24
10%	4	0	0	0	20	6	53	50	61	47	53	50	61
20%	15	0	0	20	75	47	76	55	63	47	54	54	119
30%	27	3	20	70	234	110	89	60	64	47	54	56	171
40%	37	7	64	291	684	269	110	61	65	47	54	57	243

Table 2-6
Monthly Cumulative Distribution of CALSIM-Simulated Yolo Bypass Flow (cfs) for 1922–2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Annual taf
50%	43	9	144	501	1,900	772	136	64	66	47	54	57	418
60%	49	24	293	1,854	2,518	1,463	228	67	66	47	54	57	744
70%	55	49	874	3,121	4,858	2,925	631	70	66	47	54	57	1,460
80%	58	113	2,162	6,418	7,902	4,145	2,571	74	66	47	54	77	3,408
90%	61	480	4,107	24,773	37,800	15,728	4,831	252	66	47	181	146	5,790
Max	1,250	2,750	57,349	131,642	122,751	122,683	38,245	1,580	1,118	47	654	293	12,872
Avg	69	150	2,197	8,188	10,680	7,175	1,912	151	91	47	102	75	1,861
B. CALSIM-Simulated for 1963–2003 (41 years)													
Min	0	0	0	0	0	0	42	24	52	41	41	22	24
10%	5	0	0	0	23	0	52	50	60	47	53	50	91
20%	11	0	0	3	62	44	55	59	63	47	54	53	130
30%	36	1	0	52	287	171	84	61	64	47	54	57	198
40%	41	6	34	573	861	758	110	62	65	47	54	57	376
50%	45	8	87	1,923	2,075	1,152	116	64	65	47	54	57	814
60%	51	49	233	3,157	2,746	2,200	293	68	66	47	54	58	1,287
70%	56	114	982	6,290	5,024	3,271	1,331	71	66	47	54	92	2,468
80%	59	192	2,486	7,927	14,120	5,096	2,639	75	66	47	185	148	4,452
90%	67	559	3,739	32,424	37,988	12,417	6,727	373	66	47	512	178	9,159
Max	1,250	2,750	57,349	131,642	122,751	122,683	38,245	1,580	1,118	47	654	293	12,872
Avg	97	217	2,903	12,267	13,234	9,432	2,431	169	110	47	150	94	2,483
C. Historical for 1963–2003 (41 years)													
Min	0	0	0	3	1	4	0	0	0	0	0	0	1
10%	5	11	25	25	20	26	24	21	17	3	7	4	32
20%	9	15	25	38	110	96	46	32	25	14	12	11	75
30%	17	21	30	142	717	265	46	36	33	17	15	20	154
40%	20	25	41	459	1,301	893	123	43	37	24	21	20	653

Table 2-6
Monthly Cumulative Distribution of CALSIM-Simulated Yolo Bypass Flow (cfs) for 1922–2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Annual taf
50%	20	25	171	1,571	2,515	1,080	333	51	43	32	23	27	1,306
60%	22	43	586	6,628	7,181	3,004	851	174	50	40	29	30	3,001
70%	25	149	1,131	15,733	20,132	9,011	1,378	462	79	43	34	36	4,169
80%	133	232	6,341	21,640	26,362	13,017	2,306	589	561	50	34	61	6,399
90%	193	640	10,983	41,439	45,185	18,368	8,981	1,392	608	586	499	376	9,481
Max	13,513	10,932	57,490	127,167	115,391	130,358	38,218	13,133	3,955	640	539	398	14,957
Avg	379	620	4,944	15,219	16,176	11,508	3,883	707	282	125	104	85	3,260

Notes:

CFS = Cubic feet per second; taf = thousand acre feet; CVP = Central Valley Project; SWP = State Water Project

Source: ICF 2010:3-34 and 3-35; adapted by AECOM in 2013

Table 2-7
Monthly Cumulative Distribution of CALSIM-Simulated San Joaquin River Flow (cfs) at Vernalis for 1922–2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Annual taf
A. CALSIM-Simulated for 1922–2003 (82 years)													
Min	1,060	1,305	1,345	1,099	1,366	1,277	1,112	886	594	577	640	986	869
10%	1,548	1,723	1,690	1,629	2,042	1,804	1,688	1,698	1,057	967	1,095	1,491	1,117
20%	1,839	1,859	1,858	1,766	2,147	1,974	2,493	2,413	1,334	1,171	1,289	1,674	1,397
30%	1,970	1,965	1,961	1,980	2,321	2,219	3,235	3,074	1,454	1,245	1,376	1,765	1,588
40%	2,118	2,094	2,087	2,193	2,568	2,586	3,963	3,653	1,804	1,457	1,464	1,842	1,818
50%	2,320	2,164	2,179	2,411	3,366	3,082	5,052	4,461	2,225	1,627	1,553	1,947	1,951
60%	2,578	2,356	2,281	2,531	4,462	4,979	5,451	5,165	2,595	1,839	1,775	2,243	2,709
70%	2,737	2,557	2,485	3,308	6,160	6,933	6,175	5,591	3,182	2,038	2,387	2,476	3,343
80%	2,913	2,756	2,891	5,013	9,642	8,659	7,272	7,173	7,199	3,548	2,799	2,712	4,473
90%	3,647	3,036	4,563	9,623	15,548	14,513	12,542	14,305	13,090	7,188	4,210	3,972	5,805
Max	7,538	16,747	24,168	60,107	34,475	48,555	27,422	26,218	28,027	23,800	9,146	7,945	15,990

Table 2-7
Monthly Cumulative Distribution of CALSIM-Simulated San Joaquin River Flow (cfs) at Vernalis for 1922–2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Annual taf
Avg	2,486	2,561	3,355	4,774	6,444	6,346	6,015	6,035	4,643	3,228	2,113	2,366	3,039
B. CALSIM-Simulated for 1963–2003 (41 years)													
Min	1,060	1,305	1,345	1,099	1,366	1,277	1,112	886	594	577	640	986	869
10%	1,329	1,648	1,567	1,392	1,894	1,722	1,564	1,697	910	740	891	1,328	1,031
20%	1,756	1,739	1,686	1,700	2,129	1,895	2,380	2,364	1,218	1,099	1,259	1,602	1,358
30%	1,909	1,881	1,912	2,171	2,415	2,440	3,173	3,063	1,396	1,234	1,373	1,691	1,585
40%	2,284	2,039	2,099	2,353	2,547	2,711	3,882	3,370	1,511	1,440	1,464	1,798	1,837
50%	2,424	2,176	2,204	2,455	3,563	3,602	5,168	4,513	2,516	1,698	1,716	2,096	2,252
60%	2,659	2,377	2,276	2,823	4,877	6,655	5,864	5,261	3,205	1,900	2,257	2,477	3,210
70%	2,912	2,810	2,333	4,146	8,262	7,784	6,398	5,419	6,141	2,430	2,515	2,675	3,654
80%	3,281	3,018	2,735	5,095	11,691	9,157	7,267	8,480	9,467	4,237	2,825	2,929	5,749
90%	3,809	3,396	4,610	11,918	22,400	15,883	14,394	16,865	14,144	9,676	4,666	4,043	7,242
Max	7,538	16,747	24,168	60,107	34,475	48,555	27,422	26,218	28,027	23,800	9,146	7,945	15,990
Avg	2,646	2,872	3,681	5,832	7,644	7,490	6,534	6,664	5,418	3,927	2,292	2,523	3,470
C. Historical for 1963–2003 (41 years)													
Min	246	430	506	816	758	524	212	400	118	93	124	179	416
10%	1,101	1,136	982	1,255	1,389	1,760	1,168	891	587	481	537	869	1,058
20%	1,370	1,404	1,381	1,913	1,987	2,023	1,435	1,279	1,109	1,009	892	1,067	1,219
30%	1,411	1,643	1,988	2,305	2,617	2,241	1,961	1,967	1,549	1,227	1,067	1,308	1,525
40%	1,992	1,759	2,238	2,872	3,092	2,743	2,599	2,393	1,990	1,330	1,221	1,452	1,766
50%	2,532	2,158	2,487	3,251	5,094	3,430	3,421	2,937	2,322	1,510	1,418	1,597	2,395
60%	2,706	2,355	2,812	4,059	6,645	6,536	4,285	3,972	2,737	1,756	1,627	2,029	2,843
70%	2,944	2,842	3,635	4,730	7,928	8,332	6,437	5,296	3,860	1,908	1,969	2,330	3,808
80%	3,741	3,290	4,331	6,025	9,191	12,098	10,249	9,339	6,233	2,567	2,171	2,846	5,484
90%	4,543	3,891	6,037	13,815	18,648	19,352	20,030	19,119	14,101	6,163	3,183	4,181	6,304
Max	13,323	10,876	19,126	30,377	35,057	40,035	36,447	31,771	27,887	19,227	9,035	11,310	15,459

Table 2-7
Monthly Cumulative Distribution of CALSIM-Simulated San Joaquin River Flow (cfs) at Vernalis for 1922–2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Annual taf
Avg	2,833	2,545	3,643	5,698	7,812	7,917	7,084	6,458	4,891	2,772	1,803	2,252	3,361

Notes:

CFS = Cubic feet per second; taf = thousand acre feet; CVP = Central Valley Project; SWP = State Water Project

Source: ICF 2010:3-35 and 3-36; adapted by AECOM in 2013

Table 2-8
Monthly Cumulative Distribution of CALSIM-Simulated Total Delta Inflow (cfs) for 1922–2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Annual taf
A. CALSIM-Simulated Total Delta Inflow (cfs) for 1922–2003 (82 years)													
Min	8,884	8,640	8,319	7,427	9,672	8,910	9,735	7,192	9,925	10,824	9,022	8,856	7,325
10%	10,071	10,659	11,863	14,542	17,016	14,256	13,554	10,419	13,597	16,557	10,590	10,195	10,178
20%	11,472	12,335	14,848	15,732	20,411	19,373	14,264	14,699	15,889	19,083	13,552	10,939	12,378
30%	12,288	13,400	16,327	18,880	26,400	24,261	16,296	16,120	17,249	20,843	15,120	12,996	13,330
40%	13,307	14,493	17,379	22,757	30,578	29,359	20,326	17,945	18,325	21,451	17,155	13,984	15,747
50%	14,613	15,309	19,905	30,379	42,242	33,392	23,133	20,805	19,455	22,610	17,745	15,270	17,286
60%	15,635	16,837	21,522	36,789	57,204	40,479	28,678	24,813	20,583	23,661	18,019	16,487	21,833
70%	16,400	17,426	28,633	52,684	65,833	52,213	32,172	29,167	22,119	24,052	18,330	17,143	26,202
80%	16,950	20,086	39,697	77,017	85,624	72,582	52,559	34,290	26,682	24,303	18,472	19,793	31,010
90%	19,479	28,767	74,768	109,876	132,330	99,319	72,219	59,554	44,561	26,216	19,836	23,635	39,133
Max	40,175	89,880	164,239	286,122	230,891	260,626	148,683	96,651	87,869	49,463	31,601	35,662	67,175
Avg	14,920	18,557	31,906	48,587	59,127	49,883	33,373	27,858	23,981	22,399	16,576	16,109	21,918
B. CALSIM-Simulated Total Delta Inflow for 1963–2003 (41 years)													
Min	8,884	8,640	8,319	7,427	9,672	8,910	10,582	7,192	9,925	10,824	9,098	8,856	7,325
10%	9,711	10,947	13,875	15,099	14,546	16,391	13,590	10,028	14,490	18,324	10,582	10,171	10,344
20%	11,471	12,950	15,457	18,798	21,271	21,721	14,544	14,632	16,429	20,814	14,283	10,529	12,634
30%	13,016	14,421	17,063	20,709	27,626	29,925	17,257	16,053	17,496	21,220	17,111	12,982	14,371

Table 2-8
Monthly Cumulative Distribution of CALSIM-Simulated Total Delta Inflow (cfs) for 1922–2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Annual taf
40%	13,959	15,216	19,119	29,664	31,427	33,374	22,043	17,782	18,476	22,286	17,818	14,249	17,153
50%	14,899	16,837	20,282	36,990	46,126	38,600	23,252	21,532	20,263	22,878	17,922	15,702	23,029
60%	15,738	17,244	24,757	53,240	59,402	45,664	29,205	25,243	22,032	23,733	18,311	16,923	25,677
70%	16,728	18,708	31,008	68,944	72,149	67,579	32,925	31,531	24,057	24,115	18,396	17,571	30,479
80%	17,433	22,339	40,047	85,367	103,382	73,597	53,322	35,450	26,834	25,556	18,614	21,233	34,358
90%	20,072	35,810	85,179	119,973	140,347	94,111	71,374	63,410	49,954	26,891	20,164	26,639	39,816
Max	40,175	89,880	164,239	286,122	230,891	260,626	148,683	96,651	87,869	49,463	31,601	35,662	67,175
Avg	15,623	21,128	35,233	59,745	65,282	57,293	35,235	28,981	25,885	23,783	17,286	16,896	24,276
C. Historical Total Delta Inflow (cfs) for 1968–2008 (41 years)													
Min	4,749	7,151	8,767	9,894	8,833	7,150	6,199	7,609	7,007	8,409	7,828	7,030	5,953
10%	9,931	9,140	13,456	16,018	15,120	16,656	13,806	11,989	11,794	13,219	13,428	11,977	11,089
20%	10,797	12,692	16,463	20,357	22,727	23,239	15,947	13,060	12,448	14,981	15,124	14,148	12,781
30%	12,167	14,404	18,300	23,383	27,224	27,423	16,998	15,058	14,830	16,662	16,332	15,463	13,783
40%	14,832	15,281	20,158	27,472	34,781	38,006	20,257	16,679	15,340	18,435	17,562	16,939	16,334
50%	15,841	16,349	24,733	40,664	49,178	43,949	25,394	20,085	18,131	20,656	18,901	18,419	23,390
60%	16,416	17,115	29,177	55,360	64,285	63,895	34,181	27,325	20,429	22,225	20,397	19,868	26,579
70%	17,906	18,905	31,774	69,528	83,862	76,489	42,096	34,333	28,028	23,875	21,478	21,359	32,734
80%	19,997	25,320	49,788	99,978	100,899	91,161	61,257	50,786	33,723	24,875	23,175	23,053	35,929
90%	22,640	31,343	83,570	125,071	129,294	105,687	94,841	71,513	52,117	27,796	24,574	28,420	45,561
Max	36,150	71,675	154,696	262,855	227,302	266,621	185,142	104,088	80,632	53,428	35,542	37,543	69,067
Avg	16,013	20,069	35,572	60,381	66,935	62,496	42,293	32,269	25,409	21,348	19,177	19,146	25,407

Notes:

CFS = Cubic feet per second; taf = thousand acre feet; CVP = Central Valley Project; SWP = State Water Project

Source: ICF 2010:3-37 and 3-38; adapted by AECOM in 2013

Table 2-9
Monthly Cumulative Distribution of CALSIM-Assumed Delta Channel Depletions (cfs) for 1922–2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	taf
A. Gross Consumptive Use (Evapotranspiration) for 1963–2003 from DAYFLOW													
All years	1,865	1,730	2,081	1,210	880	1,310	1,880	2,434	3,747	4,352	3,785	2,632	1,684
B. Delta Channel Depletions (cfs) for 1963–2003 (41 years) from DAYFLOW													
Min	-246	-4,217	-3,901	-6,794	-7,095	-6,836	-2,450	534	2,940	3,501	2,872	549	-29
10%	66	-2,147	-2,371	-4,771	-4,264	-4,050	-806	1,043	3,441	4,222	3,490	1,839	303
20%	485	-1,900	-1,875	-3,598	-3,597	-2,195	-30	1,570	3,494	4,296	3,739	2,311	390
30%	880	-1,319	-1,252	-2,980	-3,243	-1,551	390	1,807	3,594	4,352	3,785	2,417	645
40%	1,176	-487	-685	-1,828	-2,438	-924	650	2,082	3,670	4,352	3,785	2,570	743
50%	1,300	-36	-293	-1,205	-1,977	-727	902	2,212	3,716	4,352	3,785	2,594	824
60%	1,434	149	-76	-961	-522	-230	1,259	2,314	3,747	4,352	3,785	2,632	876
70%	1,661	872	203	-381	-294	23	1,364	2,388	3,747	4,352	3,785	2,632	933
80%	1,795	1,059	1,119	333	123	302	1,508	2,425	3,747	4,352	3,785	2,632	966
90%	1,865	1,281	1,748	609	375	672	1,643	2,434	3,747	4,352	3,785	2,632	1,042
Max	1,912	1,730	2,081	1,010	757	1,276	1,880	2,434	3,747	4,353	3,785	2,632	1,300
Avg	1,134	-342	-469	-1,718	-1,971	-1,095	629	1,980	3,686	4,289	3,711	2,367	736
C. Gross Channel Depletions (cfs) for 1963–2003 Assumed in CALSIM													
Min	980	703	755	112	359	818	1,326	478	2,460	2,869	1,944	1,153	1,224
10%	1,023	829	932	167	570	1,079	1,405	1,752	2,829	3,047	1,983	1,225	1,270
20%	1,058	989	1,139	233	715	1,260	1,505	1,785	2,959	3,092	2,062	1,301	1,286
30%	1,126	1,181	1,301	288	854	1,349	1,542	1,869	3,078	3,178	2,101	1,303	1,298
40%	1,187	1,471	1,429	417	888	1,454	1,589	1,963	3,098	3,199	2,113	1,333	1,310
50%	1,278	1,874	1,545	612	941	1,544	1,665	2,026	3,127	3,222	2,144	1,340	1,323
60%	1,440	1,975	1,663	741	1,020	1,637	1,684	2,101	3,216	3,269	2,144	1,362	1,327
70%	1,538	2,387	2,104	861	1,066	1,660	1,802	2,168	3,273	3,311	2,183	1,379	1,345
80%	1,684	2,768	2,434	1,046	1,249	1,698	1,832	2,223	3,289	3,356	2,183	1,403	1,355
90%	1,853	3,182	2,781	1,354	1,557	1,806	1,895	2,392	3,345	3,402	2,223	1,435	1,363

Table 2-9
Monthly Cumulative Distribution of CALSIM-Assumed Delta Channel Depletions (cfs) for 1922–2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	taf
Max	3,242	3,611	3,828	2,336	2,481	2,946	2,077	2,670	3,414	3,579	2,341	2,259	1,382
Avg	1,417	1,872	1,758	714	1,048	1,512	1,658	2,000	3,129	3,232	2,131	1,372	1,318
D. Delta Channel Depletions (cfs) for 1963–2001 Assumed in CALSIM													
Min	320	-814	-1,470	-5,366	-6,817	-3,422	-790	183	2,335	2,940	1,503	635	28
10%	645	7	-776	-4,025	-2,933	-894	129	1,273	2,585	3,076	1,971	991	324
20%	692	179	-437	-3,289	-2,361	-259	596	1,332	2,791	3,166	2,032	1,094	439
30%	731	371	-111	-1,613	-1,418	-151	873	1,556	2,907	3,187	2,097	1,162	577
40%	821	448	73	-1,168	-932	62	915	1,624	2,984	3,257	2,134	1,204	659
50%	885	482	230	-958	-272	207	1,020	1,814	3,028	3,302	2,153	1,249	693
60%	933	534	368	-670	-69	288	1,146	1,880	3,088	3,350	2,197	1,291	772
70%	970	583	622	-453	118	489	1,243	1,950	3,155	3,393	2,197	1,322	833
80%	1,004	618	657	-194	182	689	1,281	2,143	3,201	3,430	2,237	1,351	868
90%	1,042	653	696	-77	245	821	1,445	2,178	3,257	3,486	2,278	1,351	907
Max	1,072	690	738	40	323	1,115	1,609	2,565	3,384	3,667	2,399	1,409	978
Avg	847	378	84	-1,539	-1,008	-1	912	1,706	2,985	3,289	2,123	1,204	663

Notes:

CFS = Cubic feet per second; taf = thousand acre feet; CVP = Central Valley Project; SWP = State Water Project

Source: ICF 2010:3-39 and 3-40; adapted by AECOM in 2013

Table 2-10
Monthly Cumulative Distribution of CALSIM-Simulated CVP Deliveries (cfs) for 1922–2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	taf
A. CALSIM Assumed CVP Demands for 1922–2003 (taf)													
Agricultural	65	46	61	105	125	103	143	203	323	394	295	100	1,963
Exchange	60	20	9	9	25	69	70	96	127	149	146	95	875
Losses	7	5	5	7	10	10	14	20	30	35	29	11	184
Municipal	11	14	15	10	4	15	12	11	11	13	15	16	148
Refuges	71	45	21	9	6	6	13	28	30	8	13	54	305
Total	215	130	112	140	170	204	252	358	521	599	497	276	3,474
Total (cfs)	3,491	2,179	1,813	2,285	3,061	3,312	4,238	5,827	8,762	9,741	8,083	4,641	
B. CALSIM-Simulated CVP Deliveries for 1922–2003													
Min	1,940	1,123	697	493	776	1,365	1,649	2,310	3,188	3,220	3,066	2,411	1,412
10%	2,341	1,311	851	835	1,145	1,549	1,929	2,812	3,911	4,070	3,751	2,855	1,761
20%	2,721	1,609	1,117	1,165	1,539	1,809	2,499	3,624	5,191	5,556	4,875	3,430	2,119
30%	2,785	1,667	1,197	1,305	1,720	2,081	2,633	3,878	5,614	6,064	5,191	3,526	2,325
40%	2,876	1,727	1,337	1,531	2,047	2,281	2,824	4,268	6,256	6,835	5,585	3,669	2,530
50%	3,012	1,844	1,435	1,681	2,206	2,434	3,095	4,509	6,665	7,326	6,164	3,877	2,619
60%	3,048	1,875	1,467	1,738	2,265	2,501	3,163	4,614	6,821	7,537	6,274	3,932	2,715
70%	3,084	1,905	1,506	1,799	2,342	2,597	3,163	4,706	6,972	7,695	6,418	3,981	2,779
80%	3,158	1,965	1,586	1,923	2,521	2,657	3,234	4,891	7,276	8,060	6,700	4,076	2,889
90%	3,350	2,112	1,768	2,280	2,868	2,792	3,552	5,605	8,468	9,493	7,733	4,415	3,069
Max	3,350	2,112	1,789	2,280	2,971	3,127	3,961	5,606	8,469	9,495	7,734	4,416	3,334
Avg	2,895	1,764	1,346	1,556	2,053	2,304	2,886	4,266	6,268	6,867	5,795	3,714	2,517
C. CALSIM-Simulated CVP Agricultural Contractor Deliveries for 1963–2003													
Min	0	0	0	0	0	0	0	0	0	0	0	0	154
10%	190	145	200	352	443	206	410	632	1,055	1,269	914	300	393
20%	343	262	362	636	780	314	742	1,143	1,908	2,295	1,654	542	668
30%	417	318	440	773	943	508	854	1,390	2,320	2,790	1,967	660	846

Table 2-10
Monthly Cumulative Distribution of CALSIM-Simulated CVP Deliveries (cfs) for 1922–2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	taf
40%	533	406	562	987	1,244	708	1,044	1,766	2,948	3,545	2,348	838	1,049
50%	607	463	641	1,124	1,398	845	1,293	2,003	3,343	4,020	2,897	950	1,134
60%	635	484	670	1,176	1,455	902	1,355	2,104	3,512	4,223	3,027	998	1,229
70%	665	507	702	1,232	1,529	1,006	1,355	2,204	3,677	4,423	3,153	1,045	1,316
80%	733	559	773	1,357	1,711	1,040	1,455	2,397	4,001	4,812	3,467	1,137	1,408
90%	922	703	973	1,708	2,080	1,183	1,722	3,072	5,127	6,165	4,443	1,457	1,575
Max	922	703	973	1,708	2,154	1,493	2,130	3,073	5,128	6,167	4,444	1,458	1,831
Avg	548	418	578	1,015	1,269	746	1,126	1,811	3,022	3,634	2,605	859	1,064

Notes:

CFS = Cubic feet per second; taf = thousand acre feet; CVP = Central Valley Project; SWP = State Water Project

Source: ICF 2010:3-41 and 3-42; adapted by AECOM in 2013

Table 2-11
CVP Jones Pumping Plant Demands and Pumping Capacity

Month	Monthly CVP Jones Demand (taf)	Maximum Volume at 4,600 cfs Capacity (taf)	Additional Needed from San Luis Reservoir (taf)
October	215	283	–
November	130	274	–
December	112	283	–
January	140	283	–
February	170	255	–
March	204	283	–
April	252	274	–
May	358	283	75
June	521	274	247
July	599	283	316
August	497	283	214
September	276	274	–
Total	3,474	3,330	852

Notes:

CFS = Cubic feet per second; taf = thousand acre feet; CVP = Central Valley Project; SWP = State Water Project

Source: ICF 2010:3-43; adapted by AECOM in 2013

Table 2-12
Monthly Cumulative Distribution of CALSIM-Simulated CVP Jones Pumping (cfs) for 1922–2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Annual taf
A. CALSIM-Simulated CVP Jones Pumping (cfs) for 1922–2003 (82 years)													
Min	1,537	973	1,178	880	600	646	800	800	800	600	600	1,684	1,249
10%	3,015	2,967	3,052	2,809	1,152	1,287	800	800	1,694	1,671	1,200	2,887	1,771
20%	3,270	3,821	3,441	4,215	2,230	1,779	1,027	882	2,475	2,745	2,225	3,118	2,131
30%	3,665	4,222	4,210	4,219	3,225	2,173	1,565	1,265	2,563	3,629	3,728	4,113	2,255
40%	4,226	4,234	4,216	4,221	3,798	2,461	1,903	1,500	2,681	3,887	4,255	4,362	2,435

Table 2-12
Monthly Cumulative Distribution of CALSIM-Simulated CVP Jones Pumping (cfs) for 1922–2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Annual taf
50%	4,321	4,244	4,220	4,224	4,158	2,612	2,152	1,911	2,941	4,254	4,506	4,445	2,523
60%	4,330	4,246	4,221	4,225	4,232	3,195	2,370	1,911	3,000	4,464	4,515	4,460	2,559
70%	4,336	4,248	4,221	4,226	4,241	3,522	2,547	2,081	3,000	4,548	4,521	4,464	2,590
80%	4,346	4,251	4,223	4,227	4,242	4,029	2,547	2,274	3,000	4,576	4,531	4,469	2,703
90%	4,387	4,264	4,226	4,231	4,245	4,258	2,727	3,295	3,000	4,600	4,571	4,490	2,791
Max	4,387	4,264	4,226	4,231	4,253	4,295	3,853	4,076	3,000	4,600	4,571	4,490	2,912
Avg	3,922	3,944	3,915	3,919	3,385	2,773	1,968	1,809	2,606	3,663	3,647	3,996	2,386
B. Historical CVP Jones Pumping (cfs) for 1968–2008 (41 years)													
Min	488	0	0	0	557	641	816	843	310	354	989	1,594	1,251
10%	1,639	927	13	765	1,505	1,889	1,458	906	1,384	2,580	3,086	2,247	1,670
20%	2,087	1,309	849	1,538	2,492	2,035	1,889	1,266	2,489	3,547	4,114	3,134	1,978
30%	2,886	2,047	1,579	2,400	3,075	2,374	2,155	1,671	2,947	4,155	4,279	3,394	2,054
40%	3,397	2,500	2,212	2,921	3,547	3,270	2,509	1,923	2,989	4,331	4,364	3,695	2,276
50%	3,609	3,433	3,245	3,417	3,799	3,741	2,762	2,545	2,997	4,382	4,377	3,998	2,398
60%	3,920	3,708	3,744	3,877	3,944	3,943	3,268	2,979	3,329	4,432	4,386	4,260	2,501
70%	4,139	3,881	3,902	4,006	4,037	4,083	3,609	2,991	3,704	4,459	4,406	4,292	2,610
80%	4,243	4,111	4,066	4,126	4,098	4,112	3,824	3,109	4,160	4,540	4,477	4,361	2,681
90%	4,311	4,220	4,144	4,214	4,268	4,232	4,073	4,054	4,411	4,608	4,540	4,387	2,755
Max	4,350	4,324	4,275	4,358	4,584	4,563	4,399	4,540	4,591	4,739	4,704	4,592	3,002
Avg	3,253	2,799	2,580	2,943	3,312	3,211	2,800	2,421	3,075	3,950	4,040	3,660	2,295

Notes:

CFS = Cubic feet per second; taf = thousand acre feet; CVP = Central Valley Project; SWP = State Water Project

Source: ICF 2010:3-44; adapted by AECOM in 2013

Table 2-13
Monthly Cumulative Distribution of CALSIM-Simulated SWP Deliveries (cfs) for 1922–2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Annual taf
A. CALSIM-Simulated SWP Table A Deliveries for 1922–2003 (82 years)													
Min	603	356	285	31	34	42	1,029	1,420	2,081	2,023	1,595	1,074	1,110
10%	1,426	936	772	34	44	142	2,055	3,061	4,452	4,436	3,613	2,506	1,415
20%	2,553	2,285	1,806	38	143	267	2,219	3,605	5,214	5,130	5,068	3,651	2,025
30%	3,165	2,802	2,304	96	212	618	2,901	4,035	5,738	5,649	5,618	4,124	2,461
40%	3,686	3,274	3,008	138	507	2,289	3,468	4,163	5,862	6,008	5,742	4,325	2,704
50%	4,081	3,637	3,358	183	965	2,476	3,885	4,547	6,297	6,196	6,182	4,719	2,774
60%	4,562	4,087	3,772	442	1,076	2,638	4,291	4,989	6,891	6,718	6,713	5,303	2,954
70%	4,982	4,480	4,156	493	1,238	2,959	4,622	5,387	7,400	7,202	7,236	5,688	3,067
80%	5,064	4,559	4,223	550	1,315	3,201	4,693	5,433	7,483	7,309	7,376	5,746	3,204
90%	5,106	4,629	4,326	612	1,318	3,225	4,735	5,475	7,540	7,346	7,433	5,808	3,345
Max	5,336	5,012	4,897	612	1,340	3,274	4,807	5,557	7,660	7,479	7,575	5,925	3,505
Avg	3,731	3,294	2,993	290	747	1,929	3,579	4,419	6,169	6,087	5,931	4,504	2,635
B. CALSIM-Simulated SWP Carryover Deliveries for 1922–2003 (82 years)													
Min	0	0	0	0	0	0	0	0	0	0	0	0	0
10%	0	0	0	195	0	0	0	0	0	0	0	0	16
20%	0	0	0	266	21	0	0	0	0	0	0	0	30
30%	0	0	0	850	237	0	0	0	0	0	0	0	84
40%	0	0	0	1,961	1,187	0	0	0	0	0	0	0	218
50%	0	0	0	2,910	1,525	0	0	0	0	0	0	0	276
60%	0	0	0	3,167	1,880	0	0	0	0	0	0	0	339
70%	0	0	0	3,518	2,081	0	0	0	0	0	0	0	353
80%	0	0	0	3,773	3,007	468	0	0	0	0	0	0	376
90%	0	0	0	3,826	3,488	1,025	0	0	0	0	0	0	480

Table 2-13
Monthly Cumulative Distribution of CALSIM-Simulated SWP Deliveries (cfs) for 1922–2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Annual taf
Max	95	14	0	3,908	3,741	1,256	153	158	48	5	0	6	546
Avg	2	0	0	2,271	1,531	207	7	5	1	0	0	0	243
C. CALSIM-Simulated SWP Article 21 (Interruptible) Deliveries for 1922–2003 (82 years)													
Min	0	0	0	0	0	0	0	0	0	0	0	0	0
10%	0	0	0	0	0	0	0	0	0	0	0	0	0
20%	0	0	0	0	0	0	0	0	0	0	0	0	130
30%	0	0	0	0	0	1,359	0	0	0	0	0	0	218
40%	0	0	0	0	663	2,166	0	0	0	0	0	0	332
50%	0	0	0	774	2,230	3,007	0	0	0	0	0	0	400
60%	0	0	0	2,054	3,469	3,070	0	0	0	0	0	0	504
70%	0	0	0	2,347	3,613	3,395	187	0	0	0	0	0	609
80%	0	0	401	2,617	4,390	3,533	1,060	0	0	0	0	0	687
90%	0	0	2,378	3,632	4,983	4,281	1,699	349	0	0	34	0	827
Max	2,567	3,157	3,383	5,009	5,546	5,009	3,176	3,169	2,236	2,407	136	1,827	1,573
Avg	32	60	454	1,373	2,233	2,346	416	122	27	31	8	23	430
D. CALSIM-Simulated SWP Total Deliveries for 1922–2003 (82 years)													
Min	603	356	285	124	153	123	1,029	1,420	2,081	2,023	1,595	1,074	1,229
10%	1,426	944	775	272	1,050	792	2,077	3,084	4,452	4,436	3,613	2,506	1,857
20%	2,553	2,285	1,971	1,579	2,220	2,461	2,541	3,605	5,223	5,130	5,068	3,651	2,597
30%	3,165	2,802	2,772	2,934	3,598	3,560	3,270	4,051	5,738	5,716	5,618	4,124	2,941
40%	3,686	3,274	3,164	3,649	4,511	4,476	3,812	4,164	5,873	6,008	5,742	4,325	3,358
50%	4,081	3,637	3,556	4,095	5,292	5,410	4,286	4,599	6,297	6,196	6,182	4,719	3,462
60%	4,562	4,087	3,874	4,903	5,764	5,970	4,625	5,014	6,891	6,718	6,799	5,303	3,667
70%	5,004	4,480	4,241	5,831	6,193	6,139	4,698	5,387	7,400	7,202	7,266	5,714	3,887
80%	5,075	4,602	4,448	6,274	6,423	6,231	4,893	5,474	7,483	7,318	7,388	5,755	4,062
90%	5,145	4,720	6,014	6,672	6,646	6,256	5,852	5,684	7,542	7,351	7,433	5,812	4,215

Table 2-13
Monthly Cumulative Distribution of CALSIM-Simulated SWP Deliveries (cfs) for 1922–2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Annual taf
Max	7,579	7,669	7,562	7,411	7,566	6,937	7,953	8,684	9,812	9,674	7,575	7,489	5,342
Avg	3,765	3,354	3,447	3,934	4,511	4,482	4,001	4,546	6,197	6,118	5,939	4,527	3,308

Notes:

CFS = Cubic feet per second; taf = thousand acre feet; CVP = Central Valley Project; SWP = State Water Project

Source: ICF 2010:3-45 and 3-46; adapted by AECOM in 2013

Table 2-14
SWP Harvey O. Banks Pumping Plant Demands and Permitted Pumping Capacity

Month	Monthly SWP Banks Demand (taf)	Monthly Volume at 6,680 cfs Permitted Banks Capacity (taf)	Additional Needed from San Luis Reservoir (taf)
October	295	411	–
November	261	397	–
December	245	411	–
January	173	411	–
February	203	371	–
March	235	411	–
April	302	397	–
May	407	411	–
June	520	397	123
July	541	411	130
August	532	411	121
September	404	397	7
Total	4,118	4,836	381

Notes:

CFS = Cubic feet per second; taf = thousand acre feet; CVP = Central Valley Project; SWP = State Water Project

Source: ICF 2010:3-47 and 3-34; adapted by AECOM in 2013

Table 2-15
Monthly Cumulative Distribution of CALSIM-Simulated SWP Banks Pumping (cfs) for 1922–2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Annual taf
A. Total SWP Banks Pumping (cfs)													
Min	1,258	486	774	1,202	300	300	300	300	300	905	300	1,314	1,088
10%	2,075	2,093	3,400	4,462	1,992	1,948	301	870	754	2,598	2,053	2,331	2,116
20%	2,775	3,003	4,740	5,793	3,738	3,329	1,182	1,883	2,721	3,692	3,943	3,284	2,820
30%	3,481	3,800	5,435	6,495	5,082	4,423	2,076	2,264	3,008	5,012	5,020	4,222	3,195
40%	4,257	4,821	6,484	6,901	6,229	5,496	2,682	2,734	3,324	5,711	5,510	4,554	3,473
50%	4,921	5,626	7,052	7,138	6,535	6,296	3,456	3,251	3,553	6,017	6,102	5,603	3,801
60%	5,707	6,638	7,080	7,248	6,764	6,429	4,040	3,684	3,843	6,680	6,530	6,124	3,963
70%	6,289	6,680	7,110	7,392	7,005	6,479	4,662	4,217	3,965	6,680	6,680	6,680	4,096
80%	6,680	6,680	7,201	7,502	7,223	6,566	5,175	4,664	4,843	6,680	6,680	6,680	4,266
90%	6,680	6,680	7,418	8,047	8,072	6,753	6,125	6,165	6,680	6,680	6,680	6,680	4,615
Max	6,680	6,680	7,678	8,500	8,500	7,561	6,125	6,177	6,680	6,680	6,680	6,680	4,931
Avg	4,652	4,974	6,031	6,590	5,652	5,119	3,301	3,300	3,663	5,396	5,234	5,009	3,555
B. Article 21 Pumping (cfs) Included in Total SWP Banks Pumping													
Min	0	0	0	0	0	0	0	0	0	0	0	0	0
10%	0	0	0	0	0	0	0	0	0	0	0	0	0
20%	0	0	0	0	0	0	0	0	0	0	0	0	130
30%	0	0	0	0	0	1,359	0	0	0	0	0	0	218
40%	0	0	0	0	663	2,166	0	0	0	0	0	0	332
50%	0	0	0	774	2,230	3,007	0	0	0	0	0	0	400
60%	0	0	0	2,054	3,469	3,070	0	0	0	0	0	0	504
70%	0	0	0	2,347	3,613	3,395	187	0	0	0	0	0	609
80%	0	0	401	2,617	4,390	3,533	1,060	0	0	0	0	0	687
90%	0	0	2,378	3,632	4,983	4,281	1,699	349	0	0	34	0	827

Table 2-15
Monthly Cumulative Distribution of CALSIM-Simulated SWP Banks Pumping (cfs) for 1922–2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Annual taf
Max	2,567	3,157	3,383	5,009	5,546	5,009	3,176	3,169	2,236	2,407	136	1,827	1,573
Avg	32	60	454	1,373	2,233	2,346	416	122	27	31	8	23	430
C. Historical SWP Pumping (cfs) for 1968–2008 (41 years)													
Min	138	76	113	302	47	0	17	283	269	206	425	167	416
10%	423	890	727	655	483	706	336	594	357	533	1,580	999	1,031
20%	1,057	1,377	1,844	1,428	1,659	1,153	880	815	491	870	2,176	1,820	1,551
30%	1,859	1,877	2,744	2,717	1,912	1,823	1,267	909	955	1,781	3,502	2,793	1,871
40%	2,314	2,339	2,901	3,088	2,445	2,245	1,724	1,131	1,186	2,457	4,123	3,311	2,113
50%	2,862	2,667	3,552	3,355	3,067	2,634	1,993	1,357	2,055	3,575	4,466	3,689	2,315
60%	3,010	3,197	3,903	4,095	3,509	2,948	2,578	1,688	2,265	4,377	4,981	4,199	2,546
70%	3,604	3,586	4,343	5,771	4,734	3,713	2,713	1,914	3,012	4,734	5,584	4,795	2,677
80%	4,323	4,116	5,229	6,227	5,205	5,554	3,361	2,617	3,402	5,994	6,313	5,870	2,898
90%	5,514	5,277	6,184	6,466	6,209	6,216	4,362	3,094	4,382	6,342	6,765	6,504	3,239
Max	6,455	6,060	6,838	7,801	7,391	6,888	6,408	3,184	5,965	7,162	7,147	7,149	3,688
Avg	2,868	2,883	3,520	3,800	3,278	3,017	2,257	1,580	2,116	3,507	4,305	3,789	2,228

Notes:

CFS = Cubic feet per second; taf = thousand acre feet; CVP = Central Valley Project; SWP = State Water Project

Source: ICF 2010:3-38 and 3-49; adapted by AECOM in 2013

Table 2-16
Monthly Cumulative Distribution of CALSIM-Simulated San Luis Reservoir Storage (taf) for 1922–2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
A. SWP San Luis Storage (taf)												

Table 2-16
Monthly Cumulative Distribution of CALSIM-Simulated San Luis Reservoir Storage (taf) for 1922–2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Min	55	55	58	414	461	387	316	286	295	175	123	64
10%	177	213	405	648	862	993	857	702	504	398	300	178
20%	332	408	524	868	1,026	1,067	922	762	566	507	365	289
30%	407	545	708	941	1,067	1,067	971	823	601	563	433	376
40%	487	611	830	1,036	1,067	1,067	994	848	624	574	474	448
50%	550	681	870	1,067	1,067	1,067	1,011	893	680	593	505	513
60%	647	731	912	1,067	1,067	1,067	1,048	936	745	609	546	594
70%	689	826	1,049	1,067	1,067	1,067	1,065	966	803	652	568	626
80%	760	899	1,067	1,067	1,067	1,067	1,067	1,042	895	725	614	684
90%	972	1,036	1,067	1,067	1,067	1,067	1,067	1,067	986	914	842	871
Max	1,067	1,067	1,067	1,067	1,067	1,067	1,067	1,067	1,067	1,067	1,065	1,067
Avg	559	651	805	960	1,012	1,033	977	878	706	617	517	510
B. CVP San Luis Reservoir Storage (taf)												
Min	116	197	335	451	514	544	491	400	296	83	45	80
10%	169	303	454	616	690	735	676	573	388	191	92	114
20%	210	351	517	690	770	836	776	633	430	226	127	143
30%	238	380	542	715	823	904	843	689	465	253	140	166
40%	253	396	563	732	861	969	874	717	499	293	168	182
50%	274	415	583	761	895	972	909	740	528	328	194	214
60%	316	450	628	790	923	972	930	770	552	390	240	248
70%	356	492	660	833	969	972	948	807	606	436	284	289
80%	394	540	709	877	972	972	972	851	666	488	306	333
90%	504	634	790	971	972	972	972	948	753	563	424	441
Max	727	872	972	972	972	972	972	972	861	726	615	649
Avg	313	448	612	768	860	908	868	742	546	358	226	246
C. Combined San Luis Reservoir Storage (taf)												

Table 2-16
Monthly Cumulative Distribution of CALSIM-Simulated San Luis Reservoir Storage (taf) for 1922–2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Min	303	414	598	899	1,176	1,062	958	838	605	328	213	236
10%	410	558	926	1,340	1,578	1,761	1,594	1,291	907	650	440	367
20%	569	796	1,040	1,567	1,761	1,834	1,703	1,406	1,005	754	492	439
30%	681	874	1,251	1,660	1,868	1,952	1,771	1,492	1,085	809	593	572
40%	754	1,014	1,432	1,765	1,917	2,017	1,853	1,534	1,148	876	651	671
50%	837	1,104	1,476	1,800	1,942	2,039	1,919	1,616	1,191	919	708	730
60%	942	1,197	1,524	1,833	1,981	2,039	1,952	1,682	1,268	986	760	804
70%	1,045	1,271	1,628	1,865	2,008	2,039	1,989	1,769	1,371	1,090	848	891
80%	1,181	1,442	1,709	1,906	2,039	2,039	2,039	1,885	1,527	1,212	964	1,071
90%	1,340	1,611	1,834	1,994	2,039	2,039	2,039	2,015	1,755	1,372	1,129	1,163
Max	1,758	1,921	2,039	2,039	2,039	2,039	2,039	2,039	1,850	1,700	1,564	1,617
Avg	872	1,099	1,416	1,728	1,873	1,941	1,845	1,620	1,253	976	742	756

Notes:

CFS = Cubic feet per second; taf = thousand acre feet; CVP = Central Valley Project; SWP = State Water Project

Source: ICF 2010:3-49 and 3-50; adapted by AECOM in 2013

Table 2-17
Monthly Cumulative Distribution of CALSIM-Simulated Delta Outflow (cfs) for 1922–2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Annual taf
A. CALSIM-Simulated Delta Outflow for 1922–2003 (82 years)													
Min	3,000	3,500	3,500	4,500	6,627	6,139	6,279	4,000	4,000	4,000	3,158	3,000	3,537
10%	3,573	4,252	4,869	5,834	9,998	9,863	9,853	5,967	6,012	4,487	3,892	3,000	4,965
20%	4,000	4,500	5,185	6,613	13,026	11,722	10,401	8,641	6,466	5,874	4,000	3,000	5,857
30%	4,000	4,500	5,799	8,248	17,290	15,383	11,259	9,747	7,121	6,507	4,000	3,000	6,730
40%	4,000	4,500	6,895	12,384	23,508	20,773	13,935	11,394	7,565	7,159	4,000	3,069	8,621
50%	4,000	4,860	7,962	19,577	32,166	26,469	16,616	13,665	8,491	8,000	4,000	3,469	10,491

Table 2-17
Monthly Cumulative Distribution of CALSIM-Simulated Delta Outflow (cfs) for 1922–2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Annual taf
60%	4,198	5,015	9,476	27,289	47,278	30,241	20,894	16,134	9,785	8,019	4,128	3,960	14,333
70%	4,388	5,749	17,212	42,155	55,847	41,953	23,543	20,211	10,566	9,338	4,337	4,141	18,807
80%	4,792	8,275	28,226	69,926	76,691	62,095	44,080	26,487	14,611	10,352	4,562	6,736	23,307
90%	7,147	16,988	63,561	102,729	126,361	89,947	62,567	48,761	30,704	12,053	5,450	10,378	30,750
Max	28,552	78,667	155,482	280,126	228,438	258,182	139,947	84,316	74,541	33,710	17,194	22,702	59,486
Avg	4,986	8,789	21,690	39,478	51,113	41,785	26,785	20,315	13,231	8,630	4,585	5,218	14,878
B. CALSIM-Simulated Delta Outflow for 1963–2003 (41 years)													
Min	3,000	3,500	3,500	4,500	6,627	6,139	7,100	4,000	4,000	4,000	3,158	3,000	3,537
10%	3,570	4,500	5,069	6,155	9,865	10,837	9,851	5,779	6,082	5,031	3,991	3,000	4,957
20%	4,000	4,500	5,787	8,553	12,939	15,852	10,527	7,592	6,452	6,372	4,000	3,000	5,947
30%	4,000	4,831	5,848	9,634	19,667	18,558	11,934	10,198	6,897	6,598	4,000	3,000	6,870
40%	4,000	4,943	7,513	19,371	26,080	23,056	14,678	11,231	7,994	8,000	4,000	3,033	9,953
50%	4,000	5,041	8,498	26,294	35,393	28,629	16,556	14,142	9,441	8,000	4,067	3,774	15,315
60%	4,327	5,764	13,090	42,855	49,126	35,801	20,872	15,168	10,638	9,087	4,262	4,110	17,814
70%	4,512	6,674	19,333	62,690	61,811	58,841	24,744	22,997	11,234	10,037	4,364	4,311	22,039
80%	5,029	11,966	28,377	80,259	94,842	65,277	44,994	26,667	14,772	11,170	4,573	8,093	26,661
90%	7,612	24,923	74,593	110,861	133,538	85,034	61,010	51,604	36,035	12,844	6,088	13,396	32,563
Max	28,552	78,667	155,482	280,126	228,438	258,182	139,947	84,316	74,541	33,710	17,194	22,702	59,486
Avg	5,585	11,195	24,855	50,823	57,340	48,728	28,429	21,276	14,801	9,662	4,902	5,966	17,108
C. Historical Outflow for 1963–2003 (41 years)													
Min	2,046	3,643	4,213	3,604	3,039	3,007	2,977	3,255	2,383	2,983	2,248	1,737	2,482
10%	3,405	4,291	7,231	9,310	7,361	10,410	6,258	4,659	3,382	3,318	2,772	3,175	5,189
20%	4,184	5,478	8,986	15,120	16,859	15,761	8,729	7,291	3,782	3,854	3,335	3,761	6,528
30%	4,742	6,890	10,467	18,325	21,171	23,404	11,417	9,143	5,113	4,599	4,394	4,622	9,123
40%	5,214	8,205	15,351	21,541	34,196	27,860	12,158	10,761	6,214	5,264	4,846	5,306	12,389
50%	7,321	10,928	22,825	32,144	52,061	34,916	18,946	13,435	7,925	5,865	5,814	6,905	19,168

Table 2-17
Monthly Cumulative Distribution of CALSIM-Simulated Delta Outflow (cfs) for 1922–2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Annual taf
60%	10,608	16,202	27,133	51,440	57,330	55,986	28,628	22,057	9,223	9,123	6,487	10,476	23,183
70%	12,280	19,964	30,136	66,157	92,555	69,106	42,032	26,406	15,270	9,450	8,467	12,917	28,190
80%	14,978	25,944	47,241	100,906	103,173	85,619	61,170	41,877	21,218	11,065	9,592	14,587	30,432
90%	18,529	27,945	85,369	123,140	126,912	99,152	90,837	64,564	46,596	16,741	12,784	20,060	38,871
Max	42,900	74,137	154,587	262,325	230,854	266,623	142,192	98,659	71,736	43,759	24,484	31,442	64,590
Avg	10,203	16,355	33,074	56,182	64,265	55,055	35,718	25,363	15,597	9,163	7,065	9,775	20,381

Notes:

CFS = Cubic feet per second; taf = thousand acre feet; CVP = Central Valley Project; SWP = State Water Project

Source: ICF 2010:3-51 and 3-52; adapted by AECOM in 2013

Table 2-18
CALSIM-Simulated Required Outflow, Surplus Outflow, and Excess E/I Outflow (cfs) for 1922–2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	taf
A. Required Delta Outflow (Minimum and X2)													
Min	3,000	3,500	3,500	4,500	6,627	5,543	5,805	4,000	4,000	4,000	3,000	3,000	3,180
10%	3,000	3,500	3,500	4,500	7,211	7,230	7,957	4,114	5,115	4,000	3,000	3,000	3,838
20%	4,000	4,484	4,500	4,500	7,749	9,569	9,410	5,733	5,673	5,000	3,500	3,000	4,278
30%	4,000	4,500	4,500	4,500	9,756	11,025	10,003	6,644	6,001	5,000	3,500	3,000	4,448
40%	4,000	4,500	4,500	6,000	11,190	11,400	10,315	9,047	6,767	6,500	4,000	3,000	4,937
50%	4,000	4,500	4,500	6,000	11,400	13,793	11,197	9,632	7,522	6,500	4,000	3,000	5,667
60%	4,000	4,500	4,500	6,000	11,400	16,503	14,033	11,002	8,533	8,000	4,000	3,000	6,090
70%	4,000	4,500	4,500	6,000	17,668	17,661	15,262	14,675	9,955	8,000	4,000	3,000	6,608
80%	4,000	4,500	4,500	6,000	22,173	19,349	16,391	16,686	10,725	8,000	4,000	3,000	6,893
90%	4,000	4,500	4,500	6,000	25,447	22,760	18,666	20,219	14,975	8,000	4,000	3,000	7,408
Max	4,000	4,500	4,500	6,000	28,462	27,195	27,118	27,022	22,758	8,000	4,000	3,000	8,491
Avg	3,848	4,337	4,354	5,468	14,164	14,501	12,700	11,160	8,820	6,500	3,744	3,000	5,587

Table 2-18
CALSIM-Simulated Required Outflow, Surplus Outflow, and Excess E/I Outflow (cfs) for 1922–2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	taf
B. Surplus Delta Outflow													
Min	0	0	0	0	0	0	0	0	0	0	0	0	322
10%	0	0	369	511	0	0	0	0	0	0	0	0	1,129
20%	0	0	806	1,540	1,843	0	0	6	0	0	0	0	1,536
30%	0	0	1,571	3,248	4,807	2,781	125	754	2	0	0	0	2,338
40%	2	271	2,533	6,384	9,362	4,900	1,558	1,686	288	685	15	69	3,572
50%	190	458	3,825	13,577	18,141	8,175	2,101	2,813	876	1,328	185	469	4,713
60%	332	818	5,020	22,558	28,502	16,331	5,862	3,465	1,515	1,600	402	960	6,916
70%	454	1,449	12,712	36,155	44,663	30,796	11,063	5,399	2,526	2,076	825	1,141	12,028
80%	918	3,793	23,726	63,926	61,892	42,231	27,938	13,518	4,059	3,001	1,266	3,736	16,810
90%	3,147	12,488	59,061	96,729	109,457	71,390	45,445	32,458	12,612	4,105	1,676	7,378	23,045
Max	24,552	74,167	150,982	274,126	204,038	243,799	123,427	65,860	62,023	25,710	13,194	19,702	52,878
Avg	1,138	4,452	17,336	34,010	36,948	27,284	14,086	9,155	4,411	2,130	841	2,218	9,292
C. Excess E/I Inflow (available for Project Diversions)													
Min	0	0	0	0	0	0	1,159	452	0	1,935	498	0	704
10%	0	61	514	86	0	0	1,561	1,124	0	3,344	710	0	1,194
20%	0	253	905	942	52	0	2,123	1,374	27	3,794	805	0	1,370
30%	177	451	1,508	1,998	2,634	973	2,358	1,870	170	4,232	926	0	1,625
40%	499	694	1,848	3,535	3,777	2,314	2,832	2,331	397	4,349	1,260	167	1,936
50%	711	946	2,221	8,165	6,626	3,615	3,378	2,617	918	4,593	1,412	443	2,783
60%	776	1,241	3,167	13,128	9,626	6,044	3,732	3,063	1,457	5,115	1,728	1,162	4,373
70%	1,472	1,575	7,339	22,718	14,420	8,647	4,429	4,156	1,834	5,836	2,117	1,488	5,756
80%	1,648	2,516	14,372	38,951	21,900	15,333	10,664	6,446	2,460	6,890	2,687	1,788	8,546
90%	1,959	7,788	36,856	60,174	36,874	25,542	17,032	11,745	6,100	7,705	3,690	4,196	12,588
Max	15,132	47,478	96,121	174,576	69,432	84,228	43,526	23,575	21,074	20,871	9,290	12,010	23,334
Avg	1,124	3,143	10,793	21,071	12,736	9,567	6,412	4,642	2,124	5,500	1,893	1,466	4,855

Table 2-18
CALSIM-Simulated Required Outflow, Surplus Outflow, and Excess E/I Outflow (cfs) for 1922–2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	taf

Notes:

CFS = Cubic feet per second; taf = thousand acre feet; CVP = Central Valley Project; SWP = State Water Project; E/I = export/import

Source: ICF 2010:3-52 and 3-53; adapted by AECOM in 2013

Table 2-19
Monthly Cumulative Distribution of IDSM-Simulated Project Diversions (cfs) for 1922–2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	taf
A. Project Diversions (cfs)													
Min	0	0	0	0	0	0	0	0	0	0	0	0	0
10%	0	0	0	0	0	0	0	0	0	0	0	0	0
20%	0	0	0	0	0	0	0	0	0	0	0	0	28
30%	0	0	0	0	0	0	0	0	0	0	0	0	211
40%	0	0	0	0	11	0	0	0	0	0	0	0	215
50%	0	0	0	9	11	22	0	0	0	0	0	0	216
60%	0	0	0	9	11	22	0	0	0	0	0	0	216
70%	0	0	1,434	210	11	22	0	0	0	0	0	0	217
80%	0	0	3,497	2,629	891	22	0	0	0	0	0	0	217
90%	0	0	3,497	3,497	3,801	373	0	0	0	0	0	0	218
Max	0	0	3,497	3,497	3,801	3,497	0	0	0	0	0	0	218
Avg	0	0	1,014	802	681	291	0	0	0	0	0	0	168
B. Project Exports (cfs)													
Min	0	0	0	0	0	0	0	0	0	0	0	0	0
10%	0	0	0	0	0	0	0	0	0	0	0	0	0
20%	0	0	0	0	0	0	0	0	0	0	0	0	0
30%	0	0	0	0	0	0	0	0	0	0	0	0	1
40%	0	0	0	0	0	0	0	0	0	0	0	0	42

Table 2-19
Monthly Cumulative Distribution of IDSM-Simulated Project Diversions (cfs) for 1922–2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	taf
50%	0	0	0	0	0	0	0	0	0	0	0	0	82
60%	0	0	0	0	0	0	0	0	0	221	0	0	103
70%	0	0	0	0	0	0	0	0	0	728	0	265	146
80%	445	0	0	0	0	0	0	0	0	1,207	445	927	184
90%	811	51	0	0	0	0	0	0	0	2,122	1,357	1,374	210
Max	1,537	1,400	0	0	0	0	0	0	0	2,841	2,620	2,378	302
Avg	219	90	0	0	0	0	0	0	0	568	324	382	95
C. Project Discharge for Outflow (cfs)													
Min	0	0	0	0	0	0	0	0	0	0	0	0	0
10%	0	0	0	0	0	0	0	0	0	0	0	0	0
20%	0	0	0	0	0	0	0	0	0	0	0	0	0
30%	0	0	0	0	0	0	0	0	0	0	0	0	0
40%	0	0	0	0	0	0	0	0	0	0	0	0	0
50%	0	0	0	0	0	0	0	0	0	0	0	0	0
60%	0	0	0	0	0	0	0	0	0	0	0	0	41
70%	0	823	0	0	0	0	0	0	0	0	0	0	101
80%	1	2,083	0	0	0	0	0	0	0	0	0	0	153
90%	1,000	3,529	0	0	0	0	0	0	0	0	0	184	210
Max	1,000	3,539	0	0	0	0	0	0	0	0	0	1,000	245
Avg	167	805	0	0	0	0	0	0	0	0	0	91	63

Notes:

CFS = Cubic feet per second; taf = thousand acre feet; CVP = Central Valley Project; SWP = State Water Project

Source: ICF 2010:3-54 and 3-55; adapted by AECOM in 2013

Table 2-20
Monthly Cumulative Distribution of IDSM-Simulated Project Deliveries (cfs) for 1922–2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	taf
A. Direct CVP Deliveries (cfs)													
Min	0	0	0	0	0	0	0	0	0	0	0	0	0
10%	0	0	0	0	0	0	0	0	0	0	0	0	0
20%	0	0	0	0	0	0	0	0	0	0	0	0	0
30%	0	0	0	0	0	0	0	0	0	0	0	0	0
40%	0	0	0	0	0	0	0	0	0	0	0	0	0
50%	0	0	0	0	0	0	0	0	0	0	0	0	0
60%	0	0	0	0	0	0	0	0	0	0	0	0	0
70%	0	0	0	0	0	0	0	0	0	0	0	0	0
80%	0	0	0	0	0	0	0	0	0	0	0	0	0
90%	0	0	0	0	0	0	0	0	0	0	0	0	0
Max	0	0	0	0	0	0	0	0	0	0	0	0	0
Avg	0	0	0	0	0	0	0	0	0	0	0	0	0
B. Direct SWP Deliveries (cfs)													
Min	0	0	0	0	0	0	0	0	0	0	0	0	0
10%	0	0	0	0	0	0	0	0	0	0	0	0	0
20%	0	0	0	0	0	0	0	0	0	0	0	0	0
30%	0	0	0	0	0	0	0	0	0	0	0	0	0
40%	0	0	0	0	0	0	0	0	0	0	0	0	0
50%	0	0	0	0	0	0	0	0	0	0	0	0	14
60%	0	0	0	0	0	0	0	0	0	0	0	0	35
70%	0	0	0	0	0	0	0	0	0	335	0	78	61
80%	0	0	0	0	0	0	0	0	0	667	426	277	102
90%	210	0	0	0	0	0	0	0	0	899	940	776	121
Max	579	100	0	0	0	0	0	0	0	1,564	2,620	1,661	206
Avg	52	1	0	0	0	0	0	0	0	257	225	177	43

Table 2-20
Monthly Cumulative Distribution of IDSM-Simulated Project Deliveries (cfs) for 1922–2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	taf
C. Groundwater Bank Pumping for SWP Deliveries (cfs)													
Min	0	0	0	0	0	0	0	0	0	0	0	0	0
10%	0	0	0	0	0	0	0	0	0	0	0	0	0
20%	0	0	0	0	0	0	0	0	0	0	0	0	0
30%	0	0	0	0	0	0	0	0	0	0	0	0	0
40%	0	0	0	0	0	0	0	0	0	0	0	0	22
50%	0	0	0	0	0	0	0	0	0	0	0	0	43
60%	0	0	0	0	0	0	0	0	0	0	0	0	61
70%	0	121	0	0	0	0	0	238	177	0	0	0	71
80%	264	233	0	0	0	0	0	595	361	0	0	93	95
90%	552	427	0	0	0	0	0	788	618	0	554	426	130
Max	1,013	646	0	0	0	0	0	1,067	1,063	838	1,070	957	179
Avg	129	108	0	0	0	0	0	219	164	20	123	97	52

Notes:

CFS = Cubic feet per second; taf = thousand acre feet; CVP = Central Valley Project; SWP = State Water Project

Source: ICF 2010:3-55 and 3-56; adapted by AECOM in 2013

Table 2-21
Monthly Cumulative Distribution of IDSM-Simulated Ground Water Bank Operations for 1922–2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	taf
A. Ground Water Bank Recharge (cfs)													
Min	0	0	0	0	0	0	0	0	0	0	0	0	0
10%	0	0	0	0	0	0	0	0	0	0	0	0	0
20%	0	0	0	0	0	0	0	0	0	0	0	0	0
30%	0	0	0	0	0	0	0	0	0	0	0	0	0
40%	0	0	0	0	0	0	0	0	0	0	0	0	17
50%	0	0	0	0	0	0	0	0	0	0	0	0	49

Table 2-21
Monthly Cumulative Distribution of IDSM-Simulated Ground Water Bank Operations for 1922–2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	taf
60%	0	0	0	0	0	0	0	0	0	0	0	0	68
70%	0	0	0	0	0	0	0	0	0	287	0	6	78
80%	193	0	0	0	0	0	0	0	0	797	6	150	89
90%	801	49	0	0	0	0	0	0	0	1,287	240	1,046	117
Max	1,300	1,306	6	6	6	6	6	6	6	1,306	1,306	1,306	176
Avg	164	85	0	0	0	0	0	0	0	301	97	190	51
B. Groundwater Bank Storage (taf)													
Min	0	0	0	0	0	0	0	0	0	0	0	0	
10%	0	0	0	0	0	0	0	0	0	0	0	0	
20%	0	0	0	0	0	0	0	0	0	0	0	0	
30%	12	0	0	0	0	0	0	0	0	0	0	0	
40%	26	14	14	14	14	14	14	0	0	0	0	26	
50%	31	26	26	26	26	26	26	11	0	7	9	35	
60%	48	46	46	46	46	46	46	15	0	26	26	48	
70%	61	48	48	48	48	48	48	26	10	48	41	64	
80%	70	69	69	69	69	69	69	45	26	66	61	83	
90%	111	95	95	95	95	95	95	69	48	85	103	92	
Max	143	214	214	214	214	214	214	155	130	177	142	142	
Avg	44	40	40	40	40	40	40	25	14	31	31	41	

Notes:

CFS = Cubic feet per second; taf = thousand acre feet; CVP = Central Valley Project; SWP = State Water Project

Source: ICF 2010:3-57; adapted by AECOM in 2013

Table 2-22
CALSIM-Simulated Existing Monthly Total Delta Inflow (cfs) for Water Years 1980–2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	taf
1980	13,325	18,127	23,614	118,028	140,347	67,579	25,180	22,486	24,730	22,362	15,538	16,923	30,664
1981	14,892	13,865	17,063	31,093	31,015	30,212	18,106	14,632	18,433	21,991	14,283	13,563	14,429
1982	15,997	36,248	97,048	78,495	115,768	91,165	148,683	53,785	33,833	23,733	18,396	30,941	44,894
1983	29,866	51,894	93,821	110,382	183,554	260,626	92,876	88,500	85,155	49,463	31,601	35,662	67,175
1984	24,125	89,880	164,239	72,554	46,126	43,213	22,867	18,239	20,263	26,226	18,335	15,702	33,893
1985	16,922	35,810	24,757	17,288	18,496	16,391	16,425	17,782	17,496	22,286	18,614	15,163	14,325
1986	13,959	14,421	19,939	25,145	222,419	153,110	31,229	25,243	21,607	20,814	17,111	17,734	35,158
1987	15,738	14,871	13,875	16,212	21,271	30,910	13,791	15,747	17,053	21,220	9,992	9,766	12,094
1988	11,572	11,150	19,119	29,664	13,879	10,723	13,205	10,382	15,378	17,801	9,098	9,478	10,344
1989	9,130	10,947	11,246	14,734	10,348	53,626	23,626	16,060	16,429	22,878	17,874	11,884	13,200
1990	13,096	12,950	15,428	20,709	14,546	13,787	13,097	8,457	13,072	19,333	10,193	10,281	9,952
1991	9,711	9,265	8,319	7,427	9,672	33,410	14,544	9,683	9,925	16,546	10,865	10,423	9,037
1992	9,369	8,928	8,873	11,244	33,763	21,425	14,010	9,956	14,490	12,389	13,453	10,482	10,159
1993	8,884	8,640	14,061	68,944	62,269	38,562	41,000	32,920	34,019	23,799	18,031	17,571	22,245
1994	16,631	13,299	16,153	15,099	23,819	18,236	14,021	12,173	16,869	20,296	20,137	11,144	11,939
1995	11,471	10,994	16,675	114,507	54,733	219,490	72,313	96,651	54,997	38,247	24,051	26,639	44,693
1996	18,153	16,837	29,320	51,389	132,788	80,616	48,408	52,952	24,958	20,914	17,834	21,233	31,096
1997	13,016	20,614	110,921	286,122	85,670	31,854	22,043	18,191	18,403	20,833	18,226	14,040	39,816
1998	13,296	15,216	22,736	75,085	230,891	94,111	67,622	64,523	87,869	44,535	26,785	32,734	46,783
1999	21,906	32,251	40,047	46,837	103,382	68,464	32,925	25,302	21,147	23,897	17,882	19,442	27,360
2000	15,766	16,882	14,839	36,990	120,483	72,349	25,649	22,761	19,824	23,414	18,481	16,640	24,379
2001	14,899	16,263	19,914	20,524	27,626	28,945	14,968	12,944	13,537	19,021	10,582	10,171	12,634
2002	11,286	13,427	34,802	53,240	27,792	21,721	19,441	14,917	17,143	22,422	18,014	11,877	16,054
2003	11,239	20,680	38,293	62,337	27,521	25,222	29,245	43,057	22,032	23,693	17,818	16,440	20,367
Avg	14,760	21,394	36,463	57,669	73,257	63,573	34,803	29,473	26,611	24,088	17,216	16,914	25,112

Table 2-22
CALSIM-Simulated Existing Monthly Total Delta Inflow (cfs) for Water Years 1980–2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	taf

Notes:

CFS = Cubic feet per second; taf = thousand acre feet; CVP = Central Valley Project; SWP = State Water Project

Source: ICF 2010:3-58; adapted by AECOM in 2013

Table 2-23
CALSIM-Simulated Existing Monthly Combined CVP and SWP Export (cfs) for Water Years 1980–2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	taf
1980	8,162	10,927	11,314	12,725	10,113	8,241	7,259	5,493	6,979	9,365	8,418	11,000	6,636
1981	9,387	8,230	10,326	11,714	10,855	9,696	4,539	4,336	6,452	10,905	7,567	8,816	6,204
1982	9,800	10,929	11,307	12,001	11,158	9,931	8,513	9,936	9,680	11,280	11,251	11,170	7,660
1983	11,067	10,944	11,605	11,256	9,508	6,991	8,857	10,141	9,680	11,280	11,251	11,170	7,466
1984	11,067	10,944	10,634	8,488	9,050	9,061	4,495	3,758	6,258	10,303	11,185	10,206	6,362
1985	11,000	10,922	11,279	11,158	8,323	5,737	4,116	4,490	6,123	11,225	11,190	9,856	6,360
1986	8,638	8,997	11,300	11,549	12,741	10,129	8,058	8,383	6,018	8,004	9,864	11,140	6,928
1987	10,128	9,250	8,394	7,988	8,556	7,806	1,100	3,994	5,968	10,565	2,952	4,676	4,910
1988	6,049	5,706	11,205	11,448	2,103	1,569	3,066	1,686	4,297	8,697	1,500	4,370	3,722
1989	4,239	5,117	6,731	6,120	2,178	10,530	4,789	2,686	5,750	10,875	10,491	7,725	4,660
1990	7,791	7,369	7,761	11,350	3,231	4,825	1,100	2,341	4,460	7,497	3,859	5,212	4,030
1991	4,339	4,670	2,227	2,705	2,431	11,291	1,591	2,504	2,263	6,717	3,563	5,176	2,985
1992	5,074	2,876	4,365	4,525	11,682	7,499	1,952	1,100	3,420	3,815	6,160	5,351	3,488
1993	4,014	3,893	7,361	12,460	12,099	10,989	6,539	5,035	9,120	11,223	10,801	11,137	6,315
1994	10,810	7,909	9,420	9,439	10,719	5,978	2,648	3,204	5,904	11,257	10,346	6,047	5,652
1995	6,956	4,421	10,839	12,138	12,350	11,184	9,978	10,253	9,680	11,280	11,251	11,170	7,331
1996	11,067	10,944	11,314	11,010	9,616	8,060	7,859	6,895	7,018	7,871	10,136	11,152	6,814
1997	7,806	10,933	11,901	11,403	11,413	8,507	5,255	3,757	5,948	6,304	11,195	9,090	6,245
1998	7,941	9,891	11,295	11,195	11,380	8,694	8,866	9,765	9,680	11,280	11,251	11,170	7,385
1999	11,067	10,944	11,479	11,208	10,151	9,174	7,073	4,354	6,376	9,461	10,711	11,142	6,826

Table 2-23
CALSIM-Simulated Existing Monthly Combined CVP and SWP Export (cfs) for Water Years 1980–2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	taf
2000	10,246	10,927	8,857	11,466	11,316	10,509	6,707	5,282	6,938	7,653	11,207	10,651	6,743
2001	9,685	10,571	11,319	11,704	11,729	10,131	2,905	2,211	2,738	8,816	3,543	5,396	5,475
2002	5,687	7,727	11,278	11,717	1,100	4,600	4,168	3,925	6,000	11,055	9,975	6,684	5,063
2003	5,599	10,914	11,237	11,443	1,290	8,828	6,040	6,245	6,837	8,129	11,031	10,487	5,917
Avg	8,234	8,581	9,781	10,342	8,546	8,332	5,311	5,074	6,399	9,369	8,779	8,750	5,882

Notes:

CFS = Cubic feet per second; taf = thousand acre feet; CVP = Central Valley Project; SWP = State Water Project

Source: ICF 2010:3-59; adapted by AECOM in 2013

Table 2-24
CALSIM-Simulated Existing Monthly Delta Outflow (cfs) for Water Years 1980–2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	taf
1980	4,000	6,230	12,117	107,646	133,538	58,913	16,556	14,765	13,669	8,636	4,000	4,079	23,177
1981	4,000	4,500	5,787	19,782	19,667	20,531	11,934	7,523	7,113	6,372	3,661	3,000	6,870
1982	5,029	24,923	85,829	70,566	105,041	83,999	139,947	41,131	20,061	8,000	4,082	18,471	36,627
1983	17,696	41,570	82,737	103,574	177,494	258,182	84,000	76,159	70,931	33,710	17,194	22,702	59,486
1984	11,536	78,667	155,482	63,891	37,074	33,275	16,781	11,509	9,441	11,220	4,000	3,415	26,323
1985	4,933	25,124	13,090	6,155	9,865	10,837	10,527	10,198	6,452	6,523	4,573	3,774	6,760
1986	4,000	4,842	8,446	14,922	215,438	144,101	21,798	14,142	10,951	8,271	4,000	5,010	27,507
1987	4,000	4,500	4,500	8,117	12,939	23,056	10,643	8,585	6,605	6,367	3,991	3,000	5,810
1988	4,000	4,500	7,408	19,371	11,188	7,895	8,431	6,186	6,897	4,000	4,364	3,000	5,263
1989	3,293	4,943	3,701	8,553	7,857	42,925	16,676	10,357	6,118	7,093	4,341	3,001	7,171
1990	4,000	4,500	6,498	9,634	11,400	7,760	9,869	4,622	4,000	6,975	3,158	3,033	4,552
1991	3,858	3,504	5,091	4,500	6,627	22,380	11,193	4,826	4,006	5,031	4,244	3,039	4,724
1992	3,076	4,975	3,500	6,711	23,834	13,820	10,369	5,779	6,737	4,000	3,994	3,000	5,418
1993	3,570	3,628	6,877	62,690	53,555	27,624	32,967	25,768	20,846	8,000	4,000	4,311	15,315
1994	4,362	4,500	5,823	5,822	13,865	11,018	9,725	7,078	6,230	4,290	6,444	3,000	4,957

Table 2-24
CALSIM-Simulated Existing Monthly Delta Outflow (cfs) for Water Years 1980–2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	taf
1995	3,000	5,764	5,240	109,342	41,766	211,701	61,010	84,316	41,329	22,571	9,574	13,396	36,743
1996	5,419	4,731	17,952	42,216	126,875	72,273	39,198	44,418	13,379	8,000	4,285	8,093	23,339
1997	4,000	8,823	100,039	280,126	73,734	22,042	14,678	11,455	7,994	9,830	4,000	3,000	32,563
1998	4,000	4,946	11,313	67,364	228,438	85,034	57,779	54,253	74,541	28,363	12,079	19,753	39,088
1999	9,530	20,398	27,624	36,625	94,842	58,841	24,744	18,723	10,367	10,037	4,162	6,378	19,444
2000	4,000	5,076	4,959	26,294	113,768	61,110	17,436	15,168	8,008	11,170	4,000	4,147	16,600
2001	4,362	4,659	7,513	9,277	17,101	18,237	10,824	7,592	6,082	6,034	3,882	3,000	5,947
2002	4,000	4,861	25,164	42,855	26,239	16,569	13,338	10,515	6,788	6,598	5,046	3,000	9,953
2003	4,000	8,892	28,377	51,316	26,080	15,852	22,831	34,689	10,362	10,591	4,051	3,962	13,334
Avg	5,153	12,044	26,461	49,056	66,176	55,332	28,052	22,073	15,788	10,070	5,297	6,273	18,207

Notes:

CFS = Cubic feet per second; taf = thousand acre feet; CVP = Central Valley Project; SWP = State Water Project

Source: ICF 2010:3-60; adapted by AECOM in 2013

Table 2-25 (Preferred Alternative – Alternative 2)
IDSM-Simulated Monthly Project Diversions to Storage (cfs) for Water Years 1980–2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	taf
1980	0	0	0	3,497	11	22	0	0	0	0	0	0	217
1981	0	0	0	2,629	0	878	0	0	0	0	0	0	216
1982	0	0	3,497	9	11	22	0	0	0	0	0	0	218
1983	0	0	3,497	9	11	22	0	0	0	0	0	0	218
1984	0	0	3,497	9	11	22	0	0	0	0	0	0	218
1985	0	0	3,272	0	0	0	0	0	0	0	0	0	201
1986	0	0	0	0	3,801	86	0	0	0	0	0	0	216
1987	0	0	0	0	0	3,013	0	0	0	0	0	0	185
1988	0	0	0	2,906	0	0	0	0	0	0	0	0	179
1989	0	0	0	0	0	3,497	0	0	0	0	0	0	215

Table 2-25 (Preferred Alternative – Alternative 2)
IDSM-Simulated Monthly Project Diversions to Storage (cfs) for Water Years 1980–2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	taf
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	402	0	0	0	0	0	0	25
1992	0	0	0	0	3,121	0	0	0	0	0	0	0	180
1993	0	0	0	3,497	11	22	0	0	0	0	0	0	217
1994	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	0	0	0	3,497	11	22	0	0	0	0	0	0	217
1996	0	0	0	3,497	11	22	0	0	0	0	0	0	217
1997	0	0	3,497	9	11	22	0	0	0	0	0	0	218
1998	0	0	0	3,497	11	22	0	0	0	0	0	0	217
1999	0	0	3,497	9	11	22	0	0	0	0	0	0	218
2000	0	0	0	2,629	938	22	0	0	0	0	0	0	217
2001	0	0	0	0	703	0	0	0	0	0	0	0	39
2002	0	0	2,048	1,454	0	0	0	0	0	0	0	0	215
2003	0	0	3,497	9	0	0	0	0	0	0	0	0	216
Avg	0	0	1,096	1,131	361	338	0	0	0	0	0	0	178

Notes:

CFS = Cubic feet per second; taf = thousand acre feet; CVP = Central Valley Project; SWP = State Water Project

Source: ICF 2010:3-61 and Environmental Science Associates 2015; adapted by AECOM in 2015

Table 2-26 (Preferred Alternative – Alternative 2)
IDSM-Simulated Monthly Project Discharges for Export (cfs) for Water Years 1980–2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	taf
1980	0	0	0	0	0	0	0	0	0	0	2,067	158	136
1981	1,183	0	0	0	0	0	0	0	0	181	2,318	885	279
1982	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0	392	0	929	79
1985	0	0	0	0	0	0	0	0	0	0	0	731	43
1986	1,475	0	0	0	0	0	0	0	0	1,980	1,331	0	294
1987	127	0	0	0	0	0	0	0	0	0	0	2,307	145
1988	0	0	0	0	0	0	0	0	0	722	2,052	0	171
1989	0	0	0	0	0	0	0	0	0	0	420	1,720	128
1990	323	0	0	0	0	0	0	0	0	0	0	0	20
1991	0	0	0	0	0	0	0	0	0	340	0	0	21
1992	0	0	0	0	0	0	0	0	0	2,687	116	0	172
1993	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	193	1,400	0	0	0	0	0	0	0	0	0	0	95
1995	0	0	0	0	0	0	0	0	0	0	0	0	0
1996	0	0	0	0	0	0	0	0	0	1,861	1,081	0	181
1997	475	0	0	0	0	0	0	0	0	2,301	0	1,136	238
1998	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0	0	1,632	0	0	100
2000	766	0	0	0	0	0	0	0	0	805	0	0	97
2001	1,337	293	0	0	0	0	0	0	0	572	0	0	135
2002	0	0	0	0	0	0	0	0	0	0	996	2,236	194
2003	0	0	0	0	0	0	0	0	0	550	0	0	34
Avg	245	71	0	0	0	0	0	0	0	584	433	421	107

Table 2-26 (Preferred Alternative – Alternative 2)
IDSM-Simulated Monthly Project Discharges for Export (cfs) for Water Years 1980–2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	taf

Notes:

CFS = Cubic feet per second; taf = thousand acre feet; CVP = Central Valley Project; SWP = State Water Project

Source: ICF 2010:3-62 and Environmental Science Associates 2015; adapted by AECOM in 2015

Table 2-27 (Preferred Alternative – Alternative 2)
IDSM-Simulated Monthly Project Releases for Outflow (cfs) for Water Years 1980–2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	taf
1980	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	3,539	0	0	0	0	0	0	0	0	0	0	211
1984	0	3,539	0	0	0	0	0	0	0	0	0	0	211
1985	1,000	1,189	0	0	0	0	0	0	0	0	0	1,000	192
1986	1	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0	0	0	0	655	39
1988	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	1,000	60
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	1,000	901	0	0	0	0	0	0	0	0	0	0	115
1995	0	0	0	0	0	0	0	0	0	0	0	0	0
1996	0	3,530	0	0	0	0	0	0	0	0	0	0	210
1997	0	0	0	0	0	0	0	0	0	0	0	0	0
1998	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	0	3,530	0	0	0	0	0	0	0	0	0	0	210

Table 2-27 (Preferred Alternative – Alternative 2)
IDSM-Simulated Monthly Project Releases for Outflow (cfs) for Water Years 1980–2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	taf
2000	0	1,053	0	0	0	0	0	0	0	0	0	0	63
2001	1,000	0	0	0	0	0	0	0	0	0	0	0	61
2002	0	0	0	0	0	0	0	0	0	0	0	204	12
2003	0	0	0	0	0	0	0	0	0	0	0	0	0
Avg	125	720	0	0	0	0	0	0	0	0	0	119	58

Notes:

CFS = Cubic feet per second; taf = thousand acre feet; CVP = Central Valley Project; SWP = State Water Project

Source: ICF 2010:3-63 and Environmental Science Associates 2015; adapted by AECOM in 2015

Table 2-28 (Preferred Alternative – Alternative 2)
CALSIM-Simulated Existing End-of-Month X2 Location (km) for Water Years 1980–2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1980	87.7	84.0	77.6	58.8	51.0	54.7	65.7	70.1	72.2	76.4	83.7	85.9
1981	86.8	86.2	84.0	73.9	70.6	69.2	72.9	77.7	79.7	81.2	85.9	89.0
1982	86.0	72.8	59.0	56.0	51.9	52.3	48.5	56.7	64.8	74.6	82.9	74.1
1983	71.5	64.1	56.4	52.2	46.7	42.0	49.0	52.1	53.7	59.9	67.1	67.3
1984	72.6	59.6	50.1	53.8	59.2	61.8	67.9	72.8	75.9	75.6	83.4	87.2
1985	85.6	72.6	73.3	79.4	77.7	76.5	76.3	76.5	80.0	81.1	84.2	86.7
1986	87.0	85.7	81.0	75.1	52.7	48.4	61.5	69.1	73.6	77.2	83.9	84.4
1987	86.3	86.0	85.9	81.4	76.3	70.2	74.1	77.1	80.0	81.3	85.3	88.8
1988	87.7	86.5	82.2	73.5	74.8	77.9	78.5	81.0	81.0	85.2	85.9	89.0
1989	89.3	86.3	87.5	81.5	80.2	66.7	69.5	74.1	79.7	80.3	84.3	88.5
1990	87.6	86.4	83.2	79.2	76.5	78.6	77.5	82.9	85.8	82.5	87.5	89.4
1991	88.2	88.6	85.8	85.8	82.9	72.6	74.5	81.6	85.4	84.8	86.0	88.9
1992	89.8	86.4	88.0	83.5	72.3	72.8	75.2	80.5	81.0	85.2	86.6	89.2
1993	88.7	88.5	83.5	64.9	60.0	63.5	63.3	65.1	67.3	75.4	83.3	85.4
1994	85.9	85.9	83.9	83.2	76.4	75.9	76.7	79.4	81.3	84.7	82.7	88.0

Table 2-28 (Preferred Alternative – Alternative 2)
CALSIM-Simulated Existing End-of-Month X2 Location (km) for Water Years 1980–2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1995	89.7	85.2	84.5	61.0	60.6	48.1	53.5	52.8	58.0	64.4	73.0	73.3
1996	80.3	83.7	74.5	65.0	53.4	54.0	58.8	59.5	68.9	75.9	83.0	80.4
1997	85.0	80.4	60.3	45.8	51.3	62.4	69.1	73.2	77.3	77.1	83.9	88.3
1998	87.6	85.7	78.7	62.8	48.2	51.0	54.9	56.6	54.8	61.6	70.3	69.4
1999	74.7	70.6	67.0	63.6	55.2	56.1	63.0	67.5	73.4	75.6	83.1	82.3
2000	85.6	84.9	84.8	72.0	56.6	56.3	65.8	70.0	76.2	75.7	83.5	85.7
2001	86.1	85.7	81.9	79.0	73.4	71.1	74.3	78.1	81.0	82.0	85.7	88.9
2002	87.8	85.9	72.7	64.3	65.3	69.1	72.1	74.8	79.1	80.7	83.3	88.1
2003	87.5	81.2	70.2	62.1	64.6	69.2	68.0	64.3	72.4	74.9	83.1	84.0
Avg	85.2	81.8	76.5	69.1	64.1	63.3	67.1	70.6	74.3	77.2	82.6	84.3

Notes:

CFS = Cubic feet per second; taf = thousand acre feet; CVP = Central Valley Project; SWP = State Water Project; Km = Kilometers

Source: ICF 2010:3-64; adapted by AECOM in 2013

Table 2-29 (Preferred Alternative – Alternative 2)
IDSM-Simulated End-of-Month X2 Location (km) with Project for Water Years 1980–2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1980	87.7	84.0	77.7	59.1	51.1	54.8	65.7	70.1	72.2	76.4	83.7	85.9
1981	86.8	86.2	84.0	75.0	71.0	69.7	73.1	77.7	79.7	81.2	85.9	89.0
1982	86.0	72.8	59.3	56.1	52.0	52.3	48.5	56.7	64.8	74.6	82.9	74.1
1983	71.5	63.5	56.5	52.2	46.7	42.0	49.0	52.1	53.7	59.9	67.1	67.3
1984	72.6	59.2	50.2	53.8	59.2	61.8	67.9	72.8	75.9	75.6	83.4	87.2
1985	84.2	71.8	75.3	80.0	77.9	76.5	76.3	76.5	80.0	81.1	84.2	84.9
1986	86.4	85.5	80.9	75.1	52.8	48.5	61.5	69.1	73.6	77.2	83.9	84.4
1987	86.3	86.0	85.9	81.4	76.3	71.3	74.5	77.2	80.1	81.3	85.3	87.3
1988	87.2	86.3	82.2	75.0	75.3	78.1	78.5	81.0	81.0	85.2	85.9	89.0
1989	89.3	86.3	87.5	81.5	80.2	67.4	69.8	74.2	79.7	80.4	84.3	86.3

Table 2-29 (Preferred Alternative – Alternative 2)
IDSM-Simulated End-of-Month X2 Location (km) with Project for Water Years 1980–2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1990	86.9	86.2	83.2	79.1	76.5	78.6	77.5	82.9	85.8	82.5	87.5	89.4
1991	88.2	88.6	85.8	85.8	82.9	72.7	74.6	81.6	85.4	84.9	86.0	88.9
1992	89.8	86.4	88.0	83.5	73.4	73.2	75.3	80.5	81.0	85.2	86.6	89.2
1993	88.7	88.5	83.5	65.3	60.2	63.5	63.3	65.1	67.3	75.4	83.3	85.4
1994	84.4	84.0	83.3	83.0	76.3	75.9	76.7	79.4	81.3	84.7	82.7	88.0
1995	89.7	85.2	84.5	61.2	60.7	48.1	53.5	52.8	58.0	64.4	73.0	73.3
1996	80.3	79.4	73.1	65.2	53.5	54.0	58.8	59.5	68.9	75.9	83.0	80.4
1997	85.0	80.4	60.6	45.9	51.3	62.4	69.1	73.2	77.3	77.1	83.9	88.3
1998	87.6	85.7	78.7	63.2	48.3	51.0	54.9	56.6	54.8	61.6	70.3	69.4
1999	74.7	69.4	67.6	63.8	55.3	56.1	63.1	67.5	73.4	75.6	83.1	82.3
2000	85.6	83.4	84.3	72.6	56.8	56.4	65.8	70.0	76.2	75.7	83.5	85.7
2001	84.5	85.1	81.7	79.0	73.7	71.1	74.3	78.1	81.0	82.0	85.7	88.9
2002	87.8	85.9	73.3	64.7	65.4	69.2	72.1	74.8	79.1	80.7	83.3	87.6
2003	87.3	81.1	71.2	62.4	64.7	69.3	68.0	64.4	72.4	74.9	83.1	84.0
Avg	84.9	81.3	76.6	69.3	64.2	63.5	67.2	70.6	74.3	77.2	82.6	84.0

Notes:

CFS = Cubic feet per second; taf = thousand acre feet; CVP = Central Valley Project; SWP = State Water Project; Km = Kilometers

Source: ICF 2010:3-65; adapted by AECOM in 2013

Table 2-30 (Preferred Alternative – Alternative 2)
IDSM-Simulated Change in End-of-Month X2 Location (km) with Project for Water Years 1980–2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1980	0.0	0.0	0.0	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1981	0.0	0.0	0.0	1.1	0.4	0.5	0.1	0.0	0.0	0.0	0.0	0.0
1982	0.0	0.0	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1983	0.0	-0.6	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1984	0.0	-0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 2-30 (Preferred Alternative – Alternative 2)
IDSM-Simulated Change in End-of-Month X2 Location (km) with Project for Water Years 1980–2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1985	-1.4	-0.8	1.9	0.6	0.2	0.1	0.0	0.0	0.0	0.0	0.0	-1.8
1986	-0.6	-0.2	-0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1987	0.0	0.0	0.0	0.0	0.0	1.1	0.4	0.1	0.0	0.0	0.0	-1.5
1988	-0.5	-0.2	-0.1	1.5	0.5	0.2	0.1	0.0	0.0	0.0	0.0	0.0
1989	0.0	0.0	0.0	0.0	0.0	0.7	0.2	0.1	0.0	0.0	0.0	-2.2
1990	-0.7	-0.2	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1991	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
1992	0.0	0.0	0.0	0.0	1.1	0.4	0.1	0.0	0.0	0.0	0.0	0.0
1993	0.0	0.0	0.0	0.4	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
1994	-1.6	-1.9	-0.6	-0.2	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1995	0.0	0.0	0.0	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1996	0.0	-4.3	-1.4	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1997	0.0	0.0	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1998	0.0	0.0	0.0	0.4	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1999	0.0	-1.2	0.6	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2000	0.0	-1.4	-0.5	0.7	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0
2001	-1.6	-0.5	-0.2	-0.1	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0
2002	0.0	0.0	0.7	0.5	0.2	0.1	0.0	0.0	0.0	0.0	0.0	-0.5
2003	-0.2	-0.1	1.0	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Avg	-0.3	-0.5	0.1	0.3	0.2	0.1	0.0	0.0	0.0	0.0	0.0	-0.3

Notes:

CFS = Cubic feet per second; taf = thousand acre feet; CVP = Central Valley Project; SWP = State Water Project; Km = Kilometers

Source: ICF 2010:3-66; adapted by AECOM in 2013

Table 2-31 (Alternative 1)
IDSM-Simulated Monthly Project Diversions to Storage (cfs) for Water Years 1980-2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	taf
1980	0	0	0	3,497	11	22	0	0	0	0	0	0	217
1981	0	0	0	2,629	0	878	0	0	0	0	0	0	216
1982	0	0	3,497	9	11	22	0	0	0	0	0	0	218
1983	0	0	3,497	9	11	22	0	0	0	0	0	0	218
1984	0	0	3,497	9	11	22	0	0	0	0	0	0	218
1985	0	0	3,272	0	0	0	0	0	0	0	0	0	201
1986	0	0	0	0	3,801	86	0	0	0	0	0	0	216
1987	0	0	0	0	0	3,013	0	0	0	0	0	0	185
1988	0	0	0	2,906	0	0	0	0	0	0	0	0	179
1989	0	0	0	0	0	3,497	0	0	0	0	0	0	215
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	402	0	0	0	0	0	0	25
1992	0	0	0	0	3,121	0	0	0	0	0	0	0	180
1993	0	0	0	3,497	11	22	0	0	0	0	0	0	217
1994	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	0	0	0	3,497	11	22	0	0	0	0	0	0	217
1996	0	0	0	3,497	11	22	0	0	0	0	0	0	217
1997	0	0	3,497	9	11	22	0	0	0	0	0	0	218
1998	0	0	0	3,497	11	22	0	0	0	0	0	0	217
1999	0	0	3,497	9	11	22	0	0	0	0	0	0	218
2000	0	0	0	2,629	938	22	0	0	0	0	0	0	217
2001	0	0	0	0	703	0	0	0	0	0	0	0	39
2002	0	0	2,048	1,454	0	0	0	0	0	0	0	0	215
2003	0	0	3,497	9	0	0	0	0	0	0	0	0	216
Avg.	0	0	1,096	1,131	361	338	0	0	0	0	0	0	178

Note: cfs = cubic feet per second

Source: Environmental Science Associates 2015

Table 2-32 (Alternative 1)
IDSM-Simulated Monthly Project Discharges for Export (cfs) for Water Years 1980-2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	taf
1980	0	0	0	0	0	0	0	0	0	0	1,682	0	103
1981	292	434	0	0	0	0	0	0	0	181	1,717	0	161
1982	515	0	0	0	0	0	0	0	0	0	0	0	32
1983	0	0	0	0	0	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0	392	0	0	24
1985	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	436	377	0	0	0	0	0	0	0	1,980	1,258	0	248
1987	102	0	0	0	0	0	0	0	0	0	0	1,672	106
1988	308	0	0	0	0	0	0	0	0	722	2,052	0	189
1989	0	0	0	0	0	0	0	0	0	0	420	0	26
1990	721	304	0	0	0	0	0	0	0	0	0	0	62
1991	0	0	0	0	0	0	0	0	0	340	0	0	21
1992	0	0	0	0	0	0	0	0	0	2,687	116	0	172
1993	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	0	736	0	0	0	0	0	0	0	0	0	0	44
1995	0	0	0	0	0	0	0	0	0	0	0	0	0
1996	0	0	0	0	0	0	0	0	0	1,861	1,081	0	181
1997	475	0	0	0	0	0	0	0	0	2,301	0	36	173
1998	132	0	0	0	0	0	0	0	0	0	0	0	8
1999	0	0	0	0	0	0	0	0	0	1,632	0	0	100
2000	1	0	0	0	0	0	0	0	0	805	0	0	50
2001	0	0	0	0	0	0	0	0	0	572	0	0	35
2002	0	0	0	0	0	0	0	0	0	0	996	1,036	123
2003	417	0	0	0	0	0	0	0	0	550	0	0	59
Avg.	142	77	0	0	0	0	0	0	0	584	388	114	80

Note: cfs = cubic feet per second

Source: Environmental Science Associates 2015

Table 2-33 (Alternative 1)
IDSM-Simulated Monthly Project Releases for Outflow (cfs) for Water Years 1980-2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	taf
1980	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	1,000	0	0	0	0	0	0	0	0	0	0	1,000	121
1982	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	3,539	0	0	0	0	0	0	0	0	0	0	211
1984	0	3,539	0	0	0	0	0	0	0	0	0	0	211
1985	1,000	2,109	0	0	0	0	0	0	0	0	0	1,000	246
1986	1,000	419	0	0	0	0	0	0	0	0	0	0	86
1987	86	0	0	0	0	0	0	0	0	0	0	1,000	65
1988	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	1,000	60
1990	1,000	0	0	0	0	0	0	0	0	0	0	0	61
1991	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	1,000	1,761	0	0	0	0	0	0	0	0	0	0	166
1995	0	0	0	0	0	0	0	0	0	0	0	0	0
1996	0	3,530	0	0	0	0	0	0	0	0	0	0	210
1997	0	0	0	0	0	0	0	0	0	0	0	1,000	60
1998	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	0	3,530	0	0	0	0	0	0	0	0	0	0	210
2000	0	1,843	0	0	0	0	0	0	0	0	0	0	110
2001	1,000	1,675	0	0	0	0	0	0	0	0	0	0	161
2002	0	0	0	0	0	0	0	0	0	0	0	1,000	60
2003	0	0	0	0	0	0	0	0	0	0	0	0	0
Avg.	254	914	0	0	0	0	0	0	0	0	0	250	85

Note: cfs = cubic feet per second

Source: Environmental Science Associates 2015

Table 2-34 (Alternative 1)
IDSM-Simulated End-of-Month X2 Location (km) with Project for Water Years 1980-2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1980	87.1	83.8	77.6	59.1	51.1	54.8	65.7	70.1	72.2	76.4	83.7	85.9
1981	85.1	85.6	83.9	75.0	71.0	69.7	73.1	77.7	79.7	81.2	85.9	86.8
1982	85.3	72.6	59.2	56.0	51.9	52.3	48.5	56.7	64.8	74.6	82.9	74.1
1983	71.5	63.5	56.5	52.2	46.7	42.0	49.0	52.1	53.7	59.9	67.1	67.3
1984	72.6	59.2	50.2	53.8	59.2	61.8	67.9	72.8	75.9	75.6	83.4	87.2
1985	84.2	71.5	75.2	80.0	77.9	76.5	76.3	76.5	80.0	81.1	84.2	84.9
1986	84.7	84.3	80.5	74.9	52.8	48.5	61.5	69.1	73.6	77.2	83.9	84.4
1987	86.1	86.0	85.9	81.4	76.3	71.3	74.5	77.2	80.1	81.3	85.3	86.6
1988	87.0	86.2	82.2	74.7	75.2	78.1	78.5	81.0	81.0	85.2	85.9	89.0
1989	89.3	86.3	87.5	81.5	80.2	67.4	69.8	74.2	79.7	80.4	84.3	86.3
1990	85.2	85.6	83.0	79.1	76.5	78.6	77.5	82.9	85.8	82.5	87.5	89.4
1991	88.2	88.6	85.8	85.8	82.9	72.7	74.6	81.6	85.4	84.9	86.0	88.9
1992	89.8	86.4	88.0	83.5	73.4	73.2	75.3	80.5	81.0	85.2	86.6	89.2
1993	88.7	88.5	83.5	65.3	60.2	63.5	63.3	65.1	67.3	75.4	83.3	85.4
1994	84.4	82.8	82.9	82.9	76.3	75.9	76.7	79.4	81.2	84.7	82.7	88.0
1995	89.7	85.2	84.5	61.2	60.7	48.1	53.5	52.8	58.0	64.4	73.0	73.3
1996	80.3	79.4	73.1	65.2	53.5	54.0	58.8	59.5	68.9	75.9	83.0	80.4
1997	85.0	80.4	60.6	45.9	51.3	62.4	69.1	73.2	77.3	77.1	83.9	86.1
1998	86.9	85.5	78.7	63.2	48.3	51.0	54.9	56.6	54.8	61.6	70.3	69.4
1999	74.7	69.4	67.6	63.8	55.3	56.1	63.1	67.5	73.4	75.6	83.1	82.3
2000	85.6	82.5	84.0	72.5	56.8	56.3	65.8	70.0	76.2	75.7	83.5	85.7
2001	84.5	82.8	80.9	78.7	73.6	71.1	74.3	78.1	81.0	82.0	85.7	88.9
2002	87.8	85.9	73.3	64.7	65.4	69.2	72.1	74.8	79.1	80.7	83.3	85.9
2003	86.8	81.0	71.1	62.4	64.7	69.3	68.0	64.3	72.4	74.9	83.1	84.0
Avg.	84.6	81.0	76.5	69.3	64.2	63.5	67.2	70.6	74.3	77.2	82.6	83.7

Note: km = kilometers

Source: Environmental Science Associates 2015

Table 2-35 (Alternative 1)
IDSM-Simulated Change in End-of-Month X2 Location (km) with Project for Water Years 1980-2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1980	-0.6	-0.2	-0.1	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1981	-1.7	-0.6	-0.2	1.0	0.3	0.4	0.1	0.0	0.0	0.0	0.0	-2.2
1982	-0.7	-0.2	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1983	0.0	-0.6	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1984	0.0	-0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1985	-1.4	-1.1	1.9	0.6	0.2	0.1	0.0	0.0	0.0	0.0	0.0	-1.8
1986	-2.3	-1.4	-0.5	-0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1987	-0.2	-0.1	0.0	0.0	0.0	1.1	0.4	0.1	0.0	0.0	0.0	-2.2
1988	-0.7	-0.2	-0.1	1.2	0.4	0.1	0.0	0.0	0.0	0.0	0.0	0.0
1989	0.0	0.0	0.0	0.0	0.0	0.7	0.2	0.1	0.0	0.0	0.0	-2.2
1990	-2.4	-0.8	-0.3	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1991	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
1992	0.0	0.0	0.0	0.0	1.1	0.4	0.1	0.0	0.0	0.0	0.0	0.0
1993	0.0	0.0	0.0	0.4	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
1994	-1.6	-3.1	-1.0	-0.3	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1995	0.0	0.0	0.0	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1996	0.0	-4.3	-1.4	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1997	0.0	0.0	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-2.2
1998	-0.7	-0.2	-0.1	0.4	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1999	0.0	-1.2	0.6	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2000	0.0	-2.4	-0.8	0.6	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0
2001	-1.6	-2.9	-0.9	-0.3	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0
2002	0.0	0.0	0.7	0.5	0.2	0.1	0.0	0.0	0.0	0.0	0.0	-2.2
2003	-0.7	-0.2	0.9	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Avg.	-0.6	-0.8	0.0	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0	-0.5

Note: km = kilometers

Source: Environmental Science Associates 2015

Table 2-36 (Alternative 3)
IDSM-Simulated Monthly Project Diversions to Storage (cfs) for Water Years 1980-2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	taf
1980	0	0	0	4,000	2,428	23	0	0	0	0	0	0	387
1981	0	0	0	2,629	0	878	0	0	0	0	0	0	216
1982	0	0	4,000	2,270	12	23	0	0	0	0	0	0	388
1983	0	0	4,000	2,270	12	23	0	0	0	0	0	0	388
1984	0	0	4,000	2,270	12	23	0	0	0	0	0	0	388
1985	0	0	3,272	0	0	0	0	0	0	0	0	0	201
1986	0	0	0	0	6,000	865	0	0	0	0	0	0	386
1987	0	0	0	0	0	3,013	0	0	0	0	0	0	185
1988	0	0	0	2,906	0	0	0	0	0	0	0	0	179
1989	0	0	0	0	0	4,000	0	0	0	0	0	0	246
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	402	0	0	0	0	0	0	25
1992	0	0	0	0	3,121	0	0	0	0	0	0	0	180
1993	0	0	0	4,000	2,515	23	0	0	0	0	0	0	387
1994	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	0	0	0	4,000	2,515	23	0	0	0	0	0	0	387
1996	0	0	0	4,000	2,428	23	0	0	0	0	0	0	387
1997	0	0	4,000	2,270	12	23	0	0	0	0	0	0	388
1998	0	0	0	4,000	2,515	23	0	0	0	0	0	0	387
1999	0	0	4,000	2,270	12	23	0	0	0	0	0	0	388
2000	0	0	0	2,629	3,446	437	0	0	0	0	0	0	387
2001	0	0	0	0	703	0	0	0	0	0	0	0	39
2002	0	0	2,048	3,997	0	0	0	0	0	0	0	0	372
2003	0	0	4,000	2,270	0	0	0	0	0	0	0	0	386
Avg.	0	0	1,222	1,908	1,072	409	0	0	0	0	0	0	278

Note: cfs = cubic feet per second

Source: Environmental Science Associates 2015

Table 2-37 (Alternative 3)
IDSM-Simulated Monthly Project Discharges for Export (cfs) for Water Years 1980-2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	taf
1980	767	0	0	0	0	0	0	0	0	0	2,067	158	184
1981	1,654	1,361	0	0	0	0	0	0	0	181	2,305	936	391
1982	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0	392	0	929	79
1985	0	0	0	0	0	0	0	0	0	0	0	731	43
1986	1,475	0	0	0	0	0	0	0	0	1,980	1,331	0	294
1987	881	986	0	0	0	0	0	0	0	0	0	2,307	250
1988	39	0	0	0	0	0	0	0	0	722	2,104	0	176
1989	0	0	0	0	0	0	0	0	0	0	420	1,720	128
1990	831	0	0	0	0	0	0	0	0	0	0	0	51
1991	0	0	0	0	0	0	0	0	0	340	0	0	21
1992	0	0	0	0	0	0	0	0	0	2,687	160	0	175
1993	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	193	1,400	0	0	0	0	0	0	0	0	0	0	95
1995	0	0	0	0	0	0	0	0	0	0	0	0	0
1996	0	0	0	0	0	0	0	0	0	1,861	1,081	0	181
1997	1,712	0	0	0	0	0	0	0	0	2,301	0	2,051	369
1998	1,019	0	0	0	0	0	0	0	0	0	0	0	63
1999	0	0	0	0	0	0	0	0	0	1,632	0	0	100
2000	766	0	0	0	0	0	0	0	0	805	0	0	97
2001	1,337	358	0	0	0	0	0	0	0	572	0	0	139
2002	0	0	0	0	0	0	0	0	0	0	996	2,236	194
2003	1,792	0	0	0	0	0	0	0	0	550	0	0	144
Avg.	519	171	0	0	0	0	0	0	0	584	436	461	132

Note: cfs = cubic feet per second

Source: Environmental Science Associates 2015

Table 2-38 (Alternative 3)
IDSM-Simulated Monthly Project Releases for Outflow (cfs) for Water Years 1980-2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	taf
1980	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	1,000	0	0	0	0	0	0	0	0	0	0	0	61
1982	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	6,391	0	0	0	0	0	0	0	0	0	0	380
1984	0	6,391	0	0	0	0	0	0	0	0	0	0	380
1985	1,000	4,027	0	0	0	0	0	0	0	0	0	1,000	361
1986	44	0	0	0	0	0	0	0	0	0	0	0	3
1987	1,000	0	0	0	0	0	0	0	0	0	0	705	103
1988	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	1,000	60
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	1,000	3,750	0	0	0	0	0	0	0	0	0	0	285
1995	0	0	0	0	0	0	0	0	0	0	0	0	0
1996	0	6,382	0	0	0	0	0	0	0	0	0	0	380
1997	0	1,615	0	0	0	0	0	0	0	0	0	909	150
1998	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	0	6,382	0	0	0	0	0	0	0	0	0	0	380
2000	0	3,918	0	0	0	0	0	0	0	0	0	0	233
2001	1,000	2,784	0	0	0	0	0	0	0	0	0	0	227
2002	0	0	0	0	0	0	0	0	0	0	0	1,000	60
2003	0	0	0	0	0	0	0	0	0	0	0	0	0
Avg.	210	1,735	0	0	0	0	0	0	0	0	0	192	128

Note: cfs = cubic feet per second

Source: Environmental Science Associates 2015

Table 2-39 (Alternative 3)
IDSM-Simulated End-of-Month X2 Location (km) with Project for Water Years 1980-2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1980	86.9	83.7	77.6	59.1	51.2	54.8	65.7	70.1	72.2	76.4	83.7	85.9
1981	85.1	85.6	83.9	75.0	71.0	69.7	73.1	77.7	79.7	81.2	85.9	89.0
1982	86.0	72.8	59.4	56.3	52.0	52.3	48.5	56.7	64.8	74.6	82.9	74.1
1983	71.5	63.0	56.4	52.4	46.7	42.0	49.1	52.1	53.7	59.9	67.1	67.3
1984	72.6	59.0	50.1	54.1	59.3	61.8	67.9	72.8	75.9	75.6	83.4	87.2
1985	84.2	71.0	75.0	79.9	77.9	76.5	76.3	76.5	80.0	81.1	84.2	84.9
1986	86.4	85.5	80.9	75.1	52.9	48.5	61.5	69.1	73.6	77.2	83.9	84.4
1987	84.6	85.4	85.7	81.3	76.3	71.3	74.5	77.2	80.1	81.3	85.3	87.2
1988	87.2	86.3	82.2	74.7	75.2	78.1	78.5	81.0	81.0	85.2	85.9	89.0
1989	89.3	86.3	87.5	81.5	80.2	67.5	69.8	74.2	79.7	80.4	84.3	86.3
1990	86.9	86.2	83.2	79.1	76.5	78.6	77.5	82.9	85.8	82.5	87.5	89.4
1991	88.2	88.6	85.8	85.8	82.9	72.7	74.6	81.6	85.4	84.9	86.0	88.9
1992	89.8	86.4	88.0	83.5	73.4	73.2	75.3	80.5	81.0	85.2	86.6	89.2
1993	88.7	88.5	83.5	65.4	60.5	63.7	63.3	65.1	67.3	75.4	83.3	85.4
1994	84.4	80.7	82.2	82.7	76.2	75.8	76.7	79.4	81.2	84.7	82.7	88.0
1995	89.7	85.2	84.5	61.2	61.2	48.3	53.6	52.8	58.0	64.4	73.0	73.3
1996	80.3	77.1	72.4	65.1	53.6	54.0	58.8	59.5	68.9	75.9	83.0	80.4
1997	85.0	79.1	60.2	45.8	51.3	62.4	69.1	73.2	77.3	77.1	83.9	86.3
1998	86.9	85.5	78.7	63.2	48.4	51.1	54.9	56.6	54.8	61.6	70.3	69.4
1999	74.7	68.5	67.5	64.3	55.4	56.2	63.1	67.5	73.4	75.6	83.1	82.3
2000	85.6	80.5	83.4	72.3	56.9	56.4	65.8	70.0	76.2	75.7	83.5	85.7
2001	84.5	81.6	80.5	78.6	73.6	71.1	74.3	78.1	81.0	82.0	85.7	88.9
2002	87.8	85.9	73.3	65.2	65.6	69.2	72.1	74.8	79.1	80.7	83.3	85.9
2003	86.8	81.0	71.3	62.8	64.8	69.3	68.0	64.4	72.4	74.9	83.1	84.0
Avg.	84.7	80.6	76.4	69.4	64.3	63.5	67.2	70.6	74.3	77.2	82.6	83.8

Note: km = kilometers

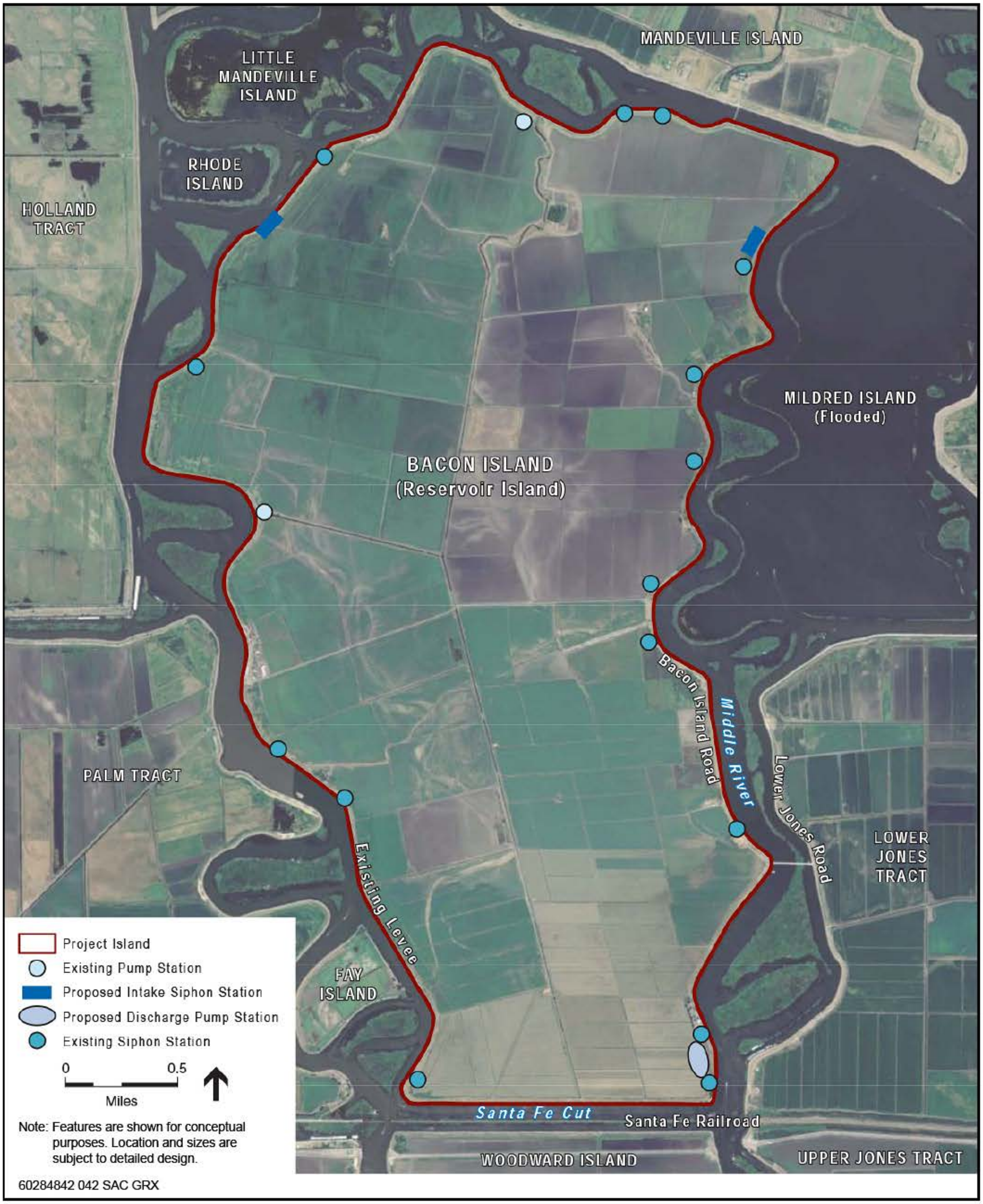
Source: Environmental Science Associates 2015

Table 2-40 (Alternative 3)
IDSM-Simulated Change in End-of-Month X2 Location (km) with Project for Water Years 1980-2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1980	-0.7	-0.2	-0.1	0.3	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0
1981	-1.7	-0.6	-0.2	1.0	0.3	0.4	0.1	0.0	0.0	0.0	0.0	0.0
1982	0.0	0.0	0.4	0.4	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1983	0.0	-1.1	0.0	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1984	0.0	-0.6	0.0	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1985	-1.4	-1.6	1.7	0.6	0.2	0.1	0.0	0.0	0.0	0.0	0.0	-1.8
1986	-0.7	-0.2	-0.1	0.0	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0
1987	-1.7	-0.6	-0.2	-0.1	0.0	1.1	0.3	0.1	0.0	0.0	0.0	-1.6
1988	-0.5	-0.2	-0.1	1.2	0.4	0.1	0.0	0.0	0.0	0.0	0.0	0.0
1989	0.0	0.0	0.0	0.0	0.0	0.7	0.2	0.1	0.0	0.0	0.0	-2.2
1990	-0.7	-0.2	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1991	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
1992	0.0	0.0	0.0	0.0	1.1	0.4	0.1	0.0	0.0	0.0	0.0	0.0
1993	0.0	0.0	0.0	0.5	0.5	0.2	0.1	0.0	0.0	0.0	0.0	0.0
1994	-1.6	-5.2	-1.7	-0.6	-0.2	-0.1	0.0	0.0	0.0	0.0	0.0	0.0
1995	0.0	0.0	0.0	0.3	0.6	0.2	0.1	0.0	0.0	0.0	0.0	0.0
1996	0.0	-6.5	-2.1	0.1	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0
1997	0.0	-1.3	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-2.0
1998	-0.7	-0.2	-0.1	0.4	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0
1999	0.0	-2.1	0.5	0.7	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0
2000	0.0	-4.4	-1.4	0.3	0.3	0.2	0.1	0.0	0.0	0.0	0.0	0.0
2001	-1.6	-4.1	-1.3	-0.4	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0
2002	0.0	0.0	0.7	1.0	0.3	0.1	0.0	0.0	0.0	0.0	0.0	-2.2
2003	-0.7	-0.2	1.1	0.7	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Avg.	-0.5	-1.2	-0.1	0.3	0.2	0.2	0.1	0.0	0.0	0.0	0.0	-0.4

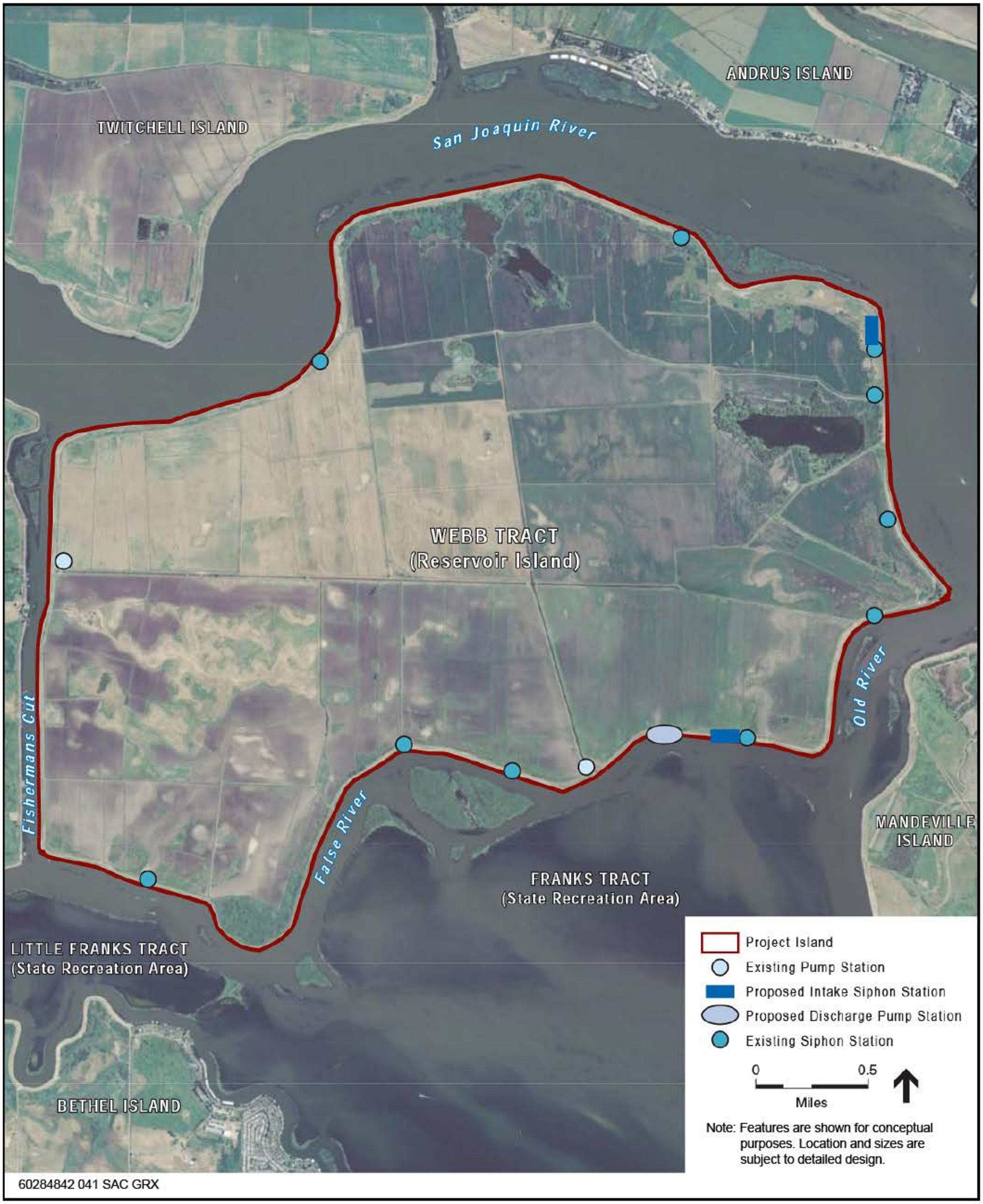
Note: km = kilometers

Source: Environmental Science Associates 2015



Source: Environmental Science Associates 2014, Adapted by AECOM in 2014

Exhibit 2-1 **Proposed Project Facilities on Bacon Island Under Alternatives 1, 2, and 3**



Source: Environmental Science Associates 2014, Adapted by AECOM in 2014

Exhibit 2-2 Proposed Project Facilities on Webb Tract Under Alternatives 1, 2, and 3

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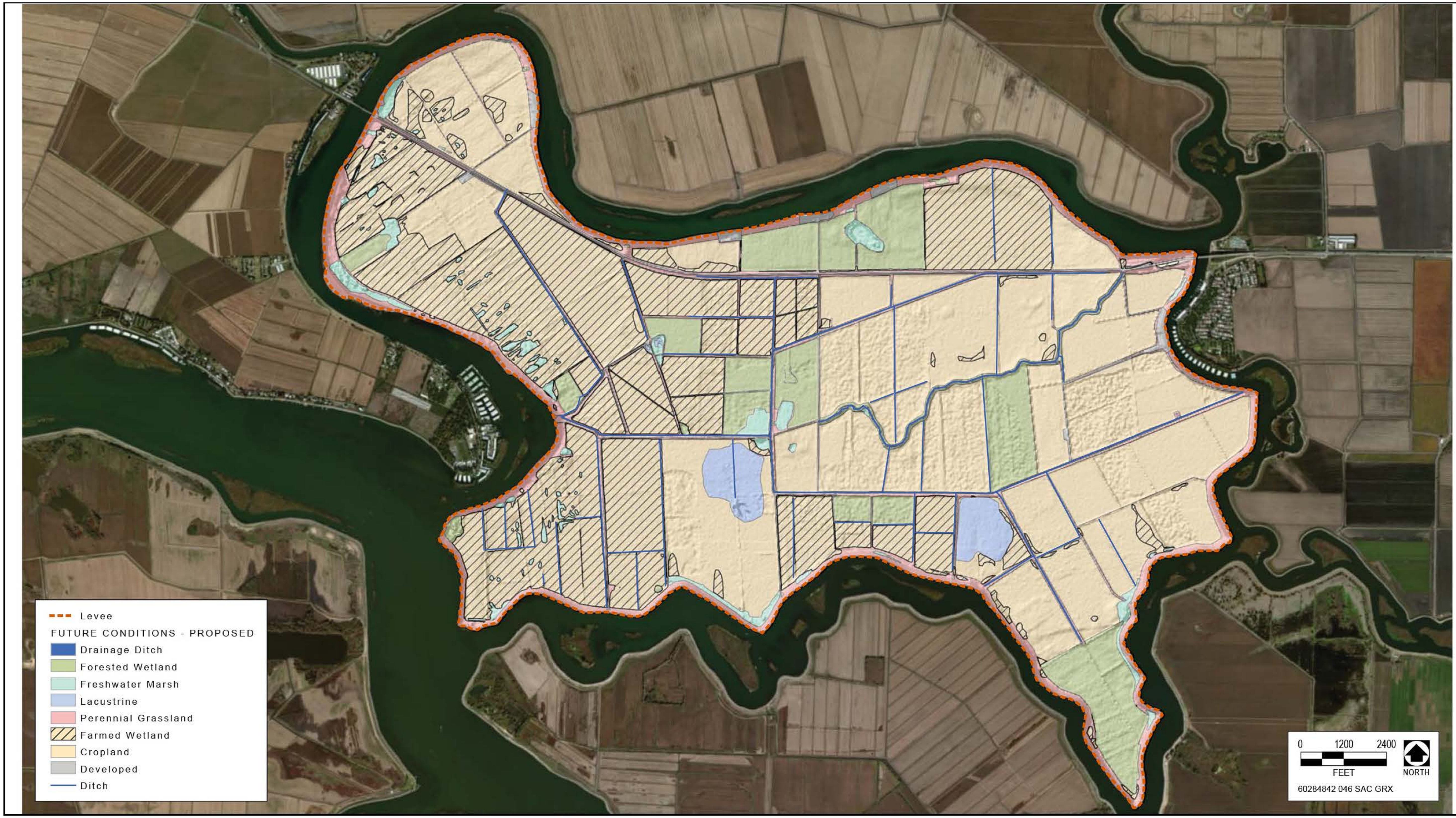
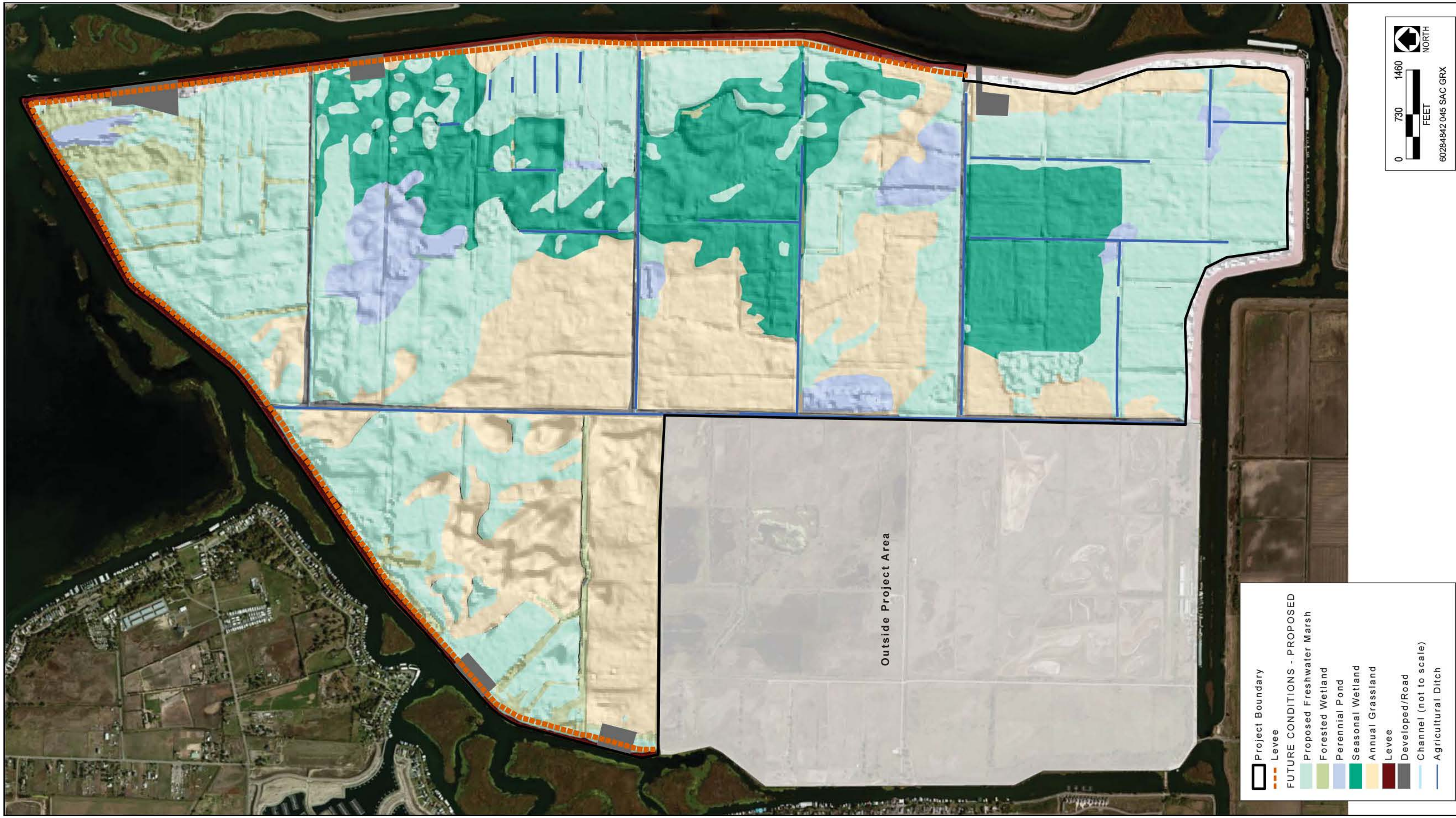


Source: Environmental Science Associates 2014, Adapted by AECOM in 2014

Exhibit 2-3 Habitats and Proposed Project Facilities on Bouldin Island Under Alternatives 1 and 2

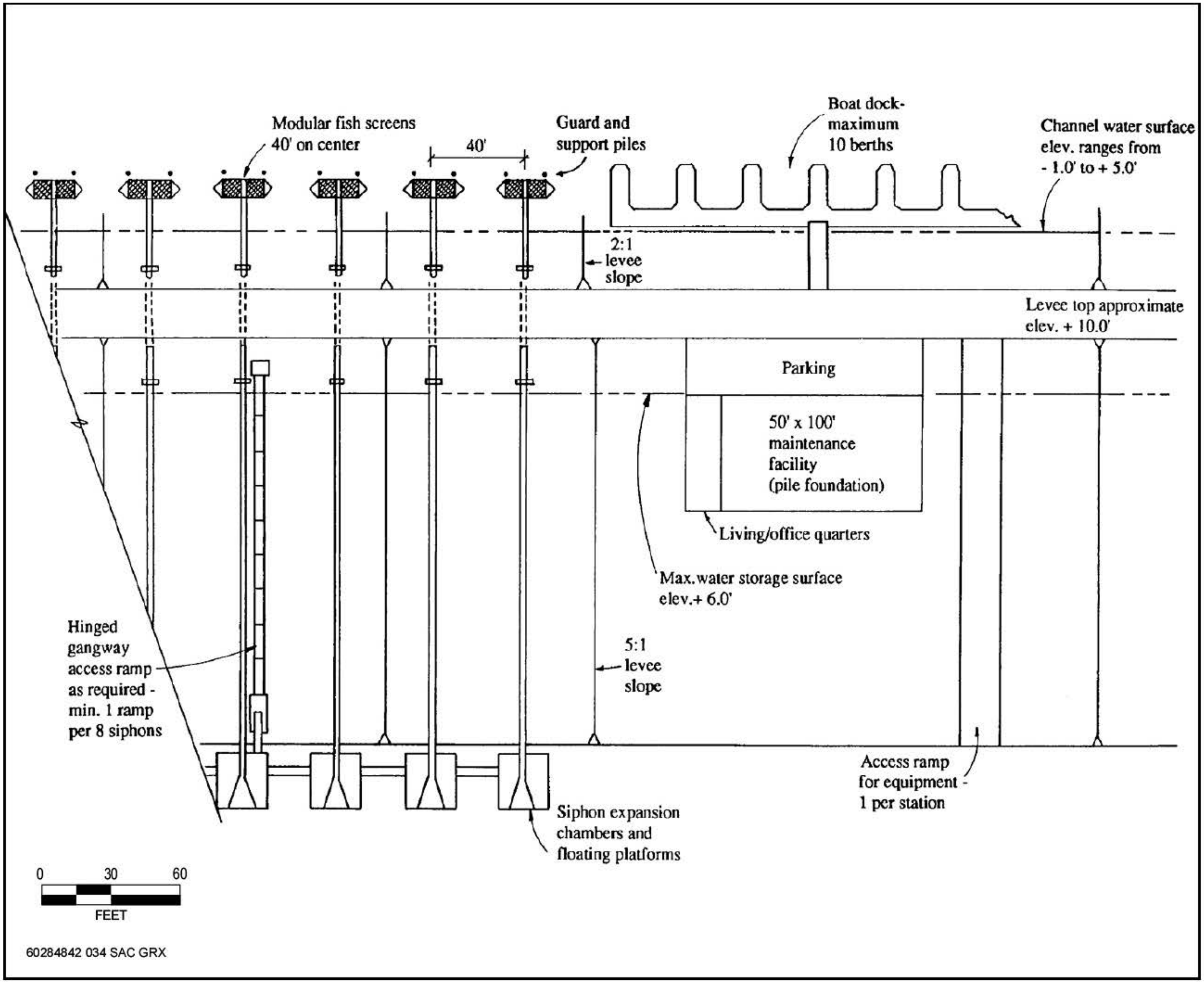


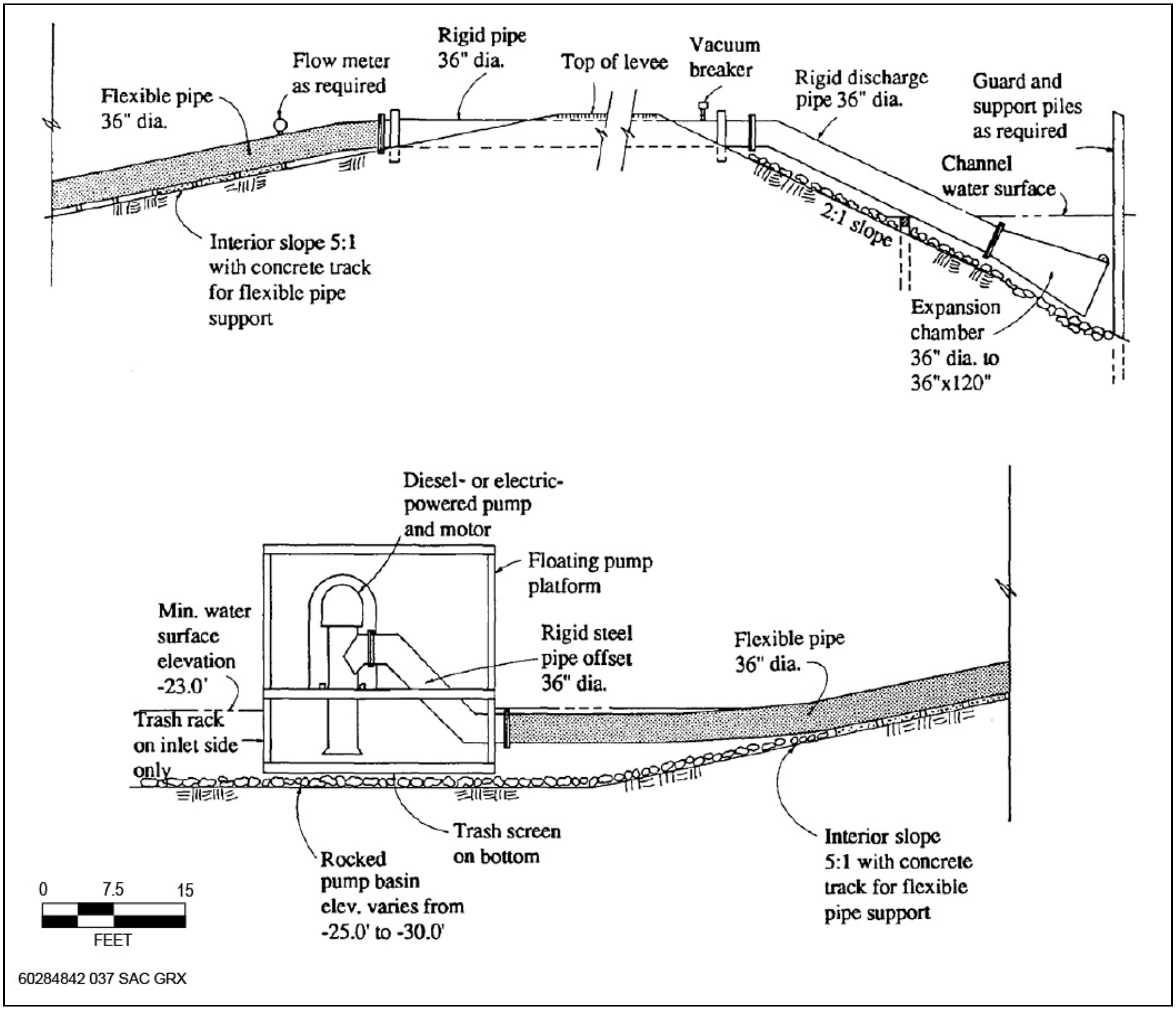
Source: Environmental Science Associates 2014, Adapted by AECOM in 2014

Exhibit 2-4 Habitats and Proposed Project Facilities on Holland Tract Under Alternatives 1 and 2

Exhibit 2-5 **Proposed Siphon Station – Plan View**

Source: ICF 1995:Appendix 2

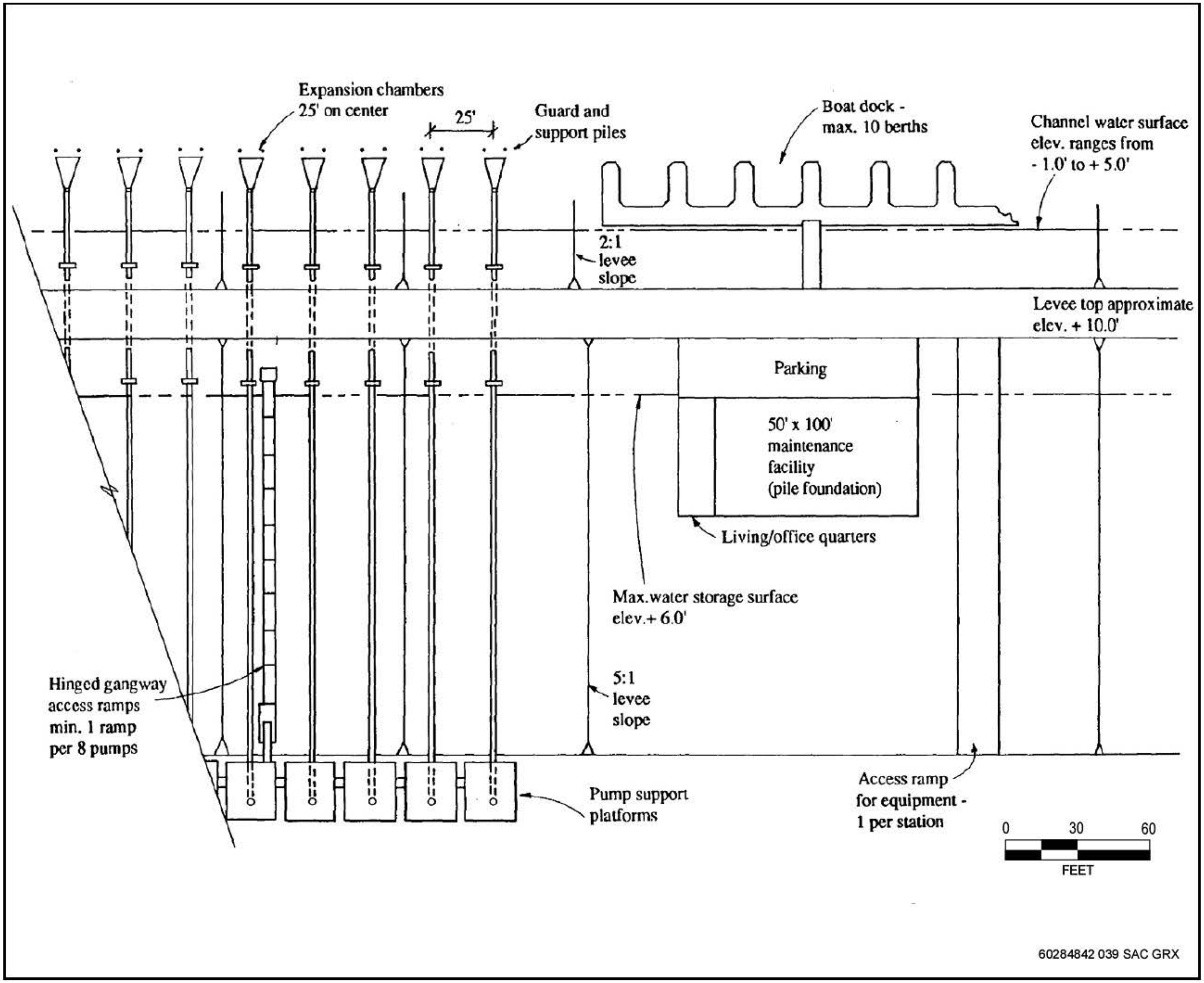




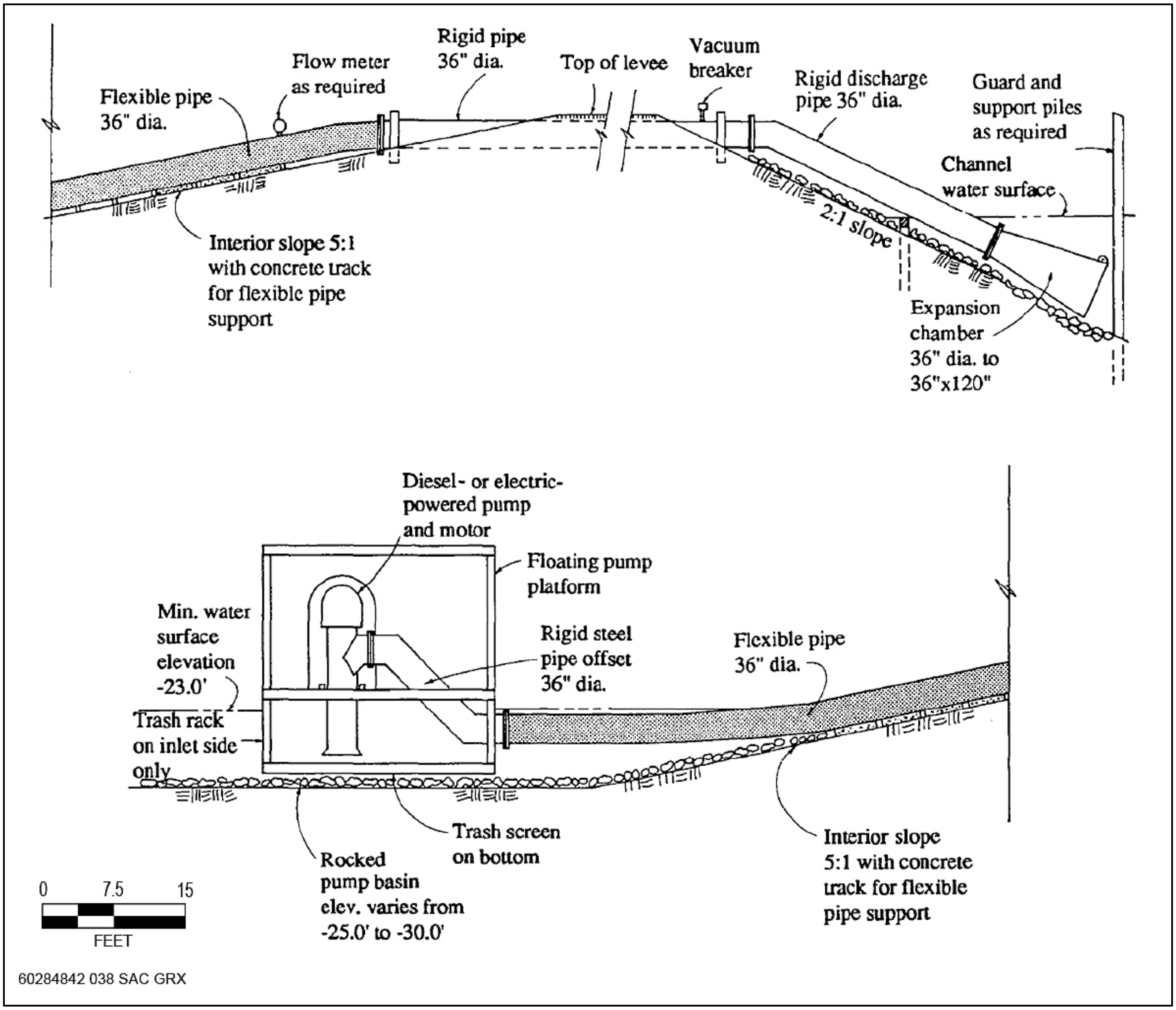
Source: ICF 1995:Appendix 2

Exhibit 2-6 **Conceptual Siphon Unit Profile**

Exhibit 2-7 Proposed Pump Station – Plan View



Source: ICF 1995:Appendix 2

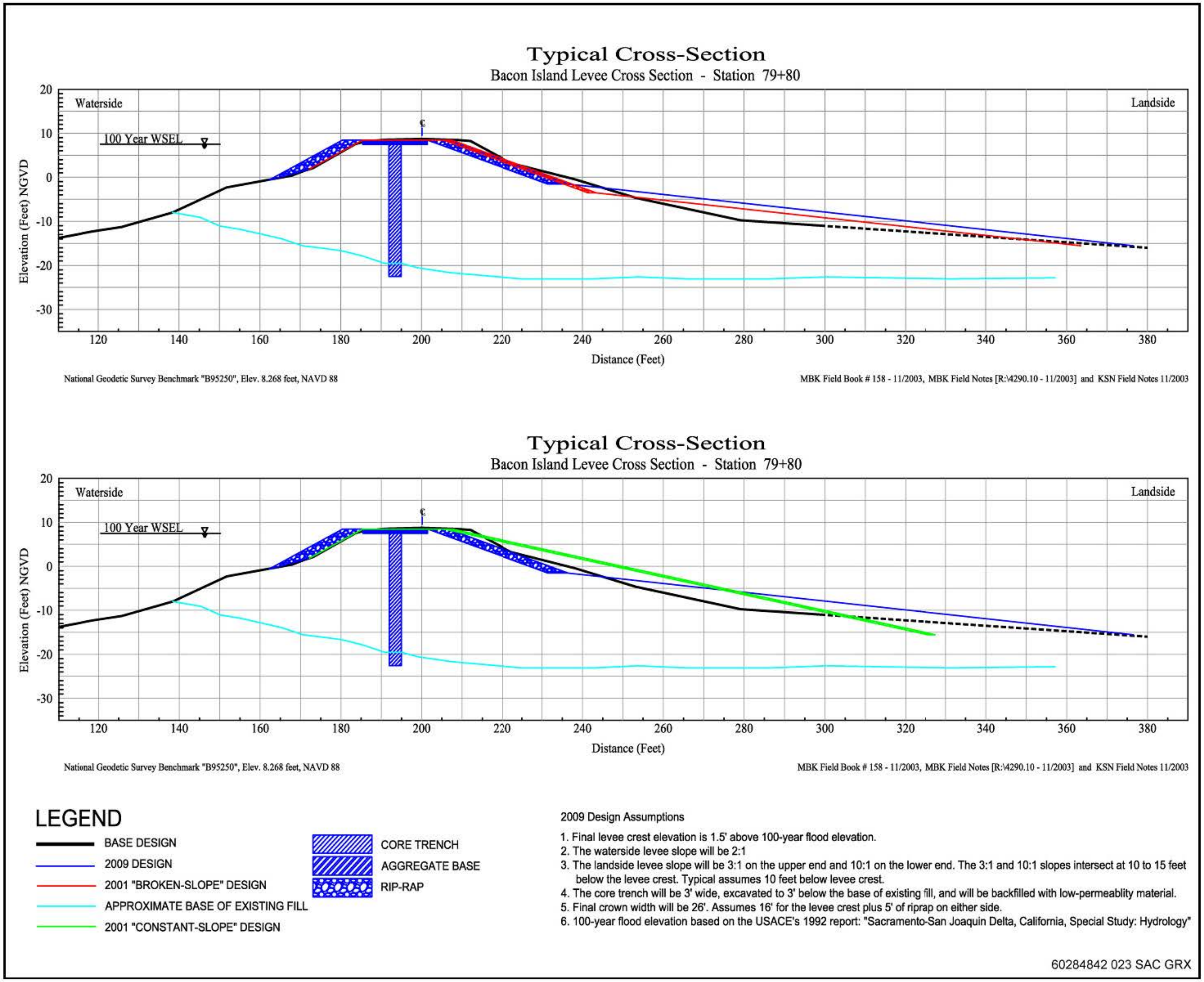


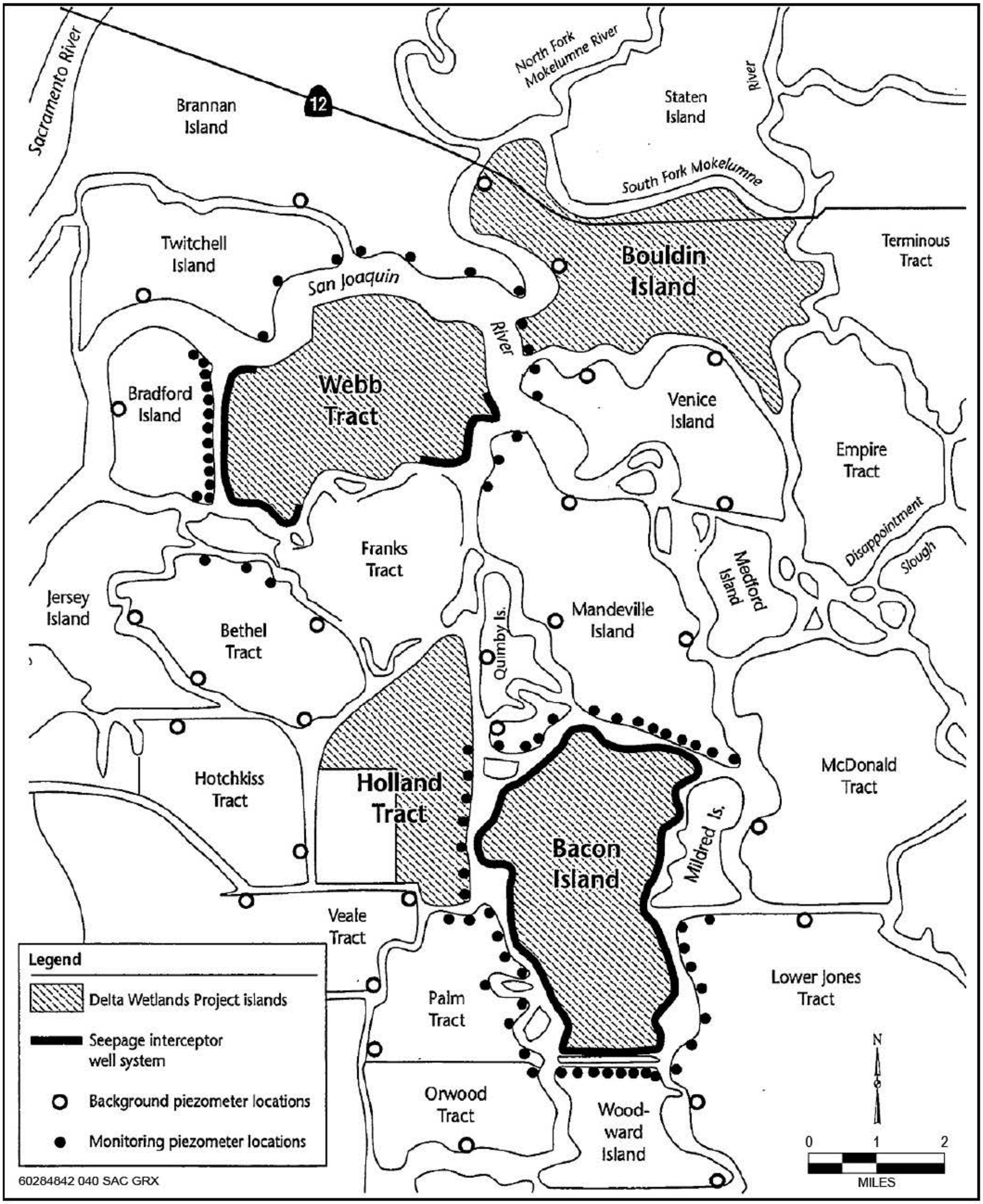
Source: ICF 1995:Appendix 2

Exhibit 2-8 **Conceptual Pump Unit Profile**

Exhibit 2-9 **Typical Levee Cross Section for the Project Islands**

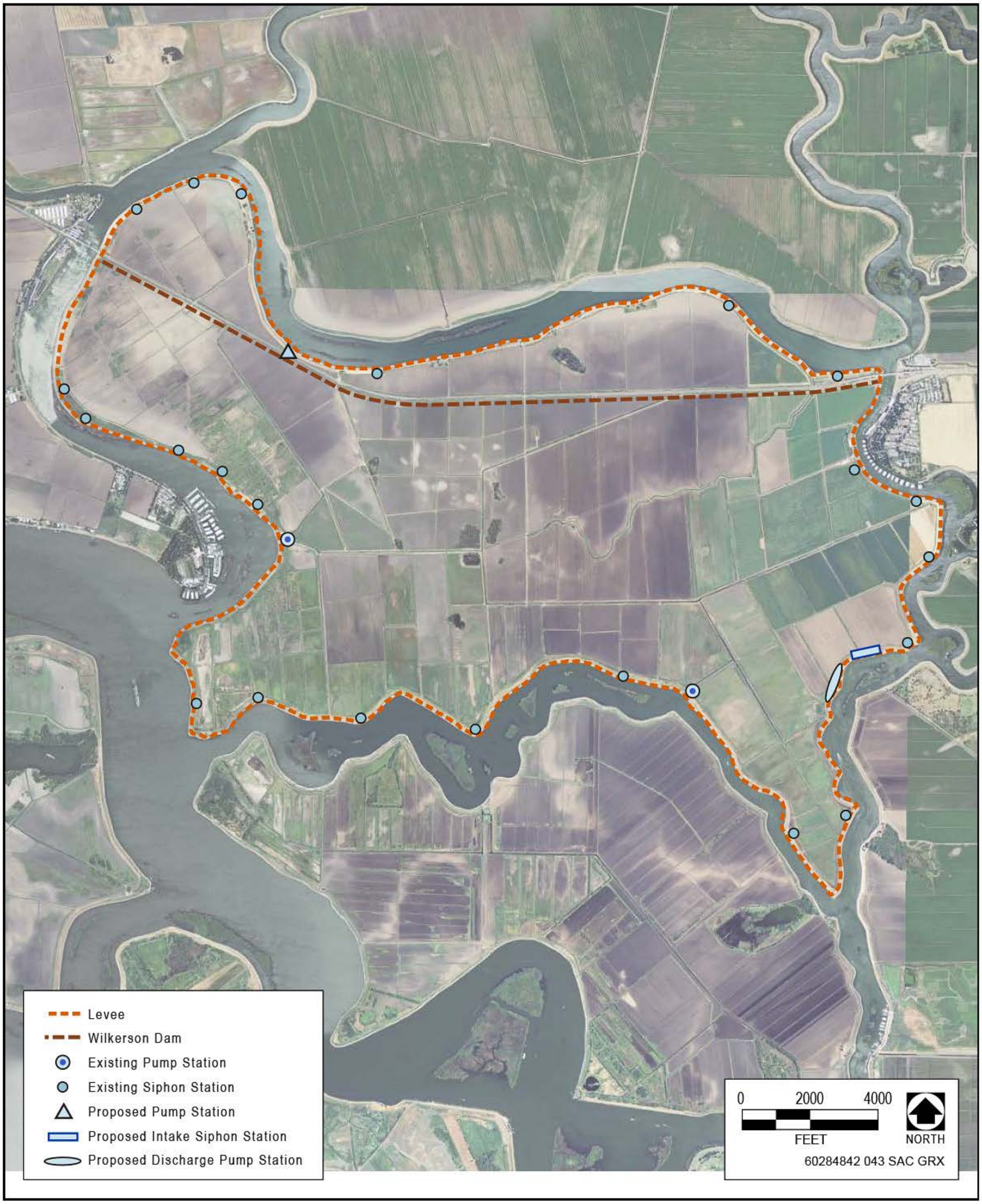
Source: ICF 2010:Section 4.3; adapted by AECOM in 2013





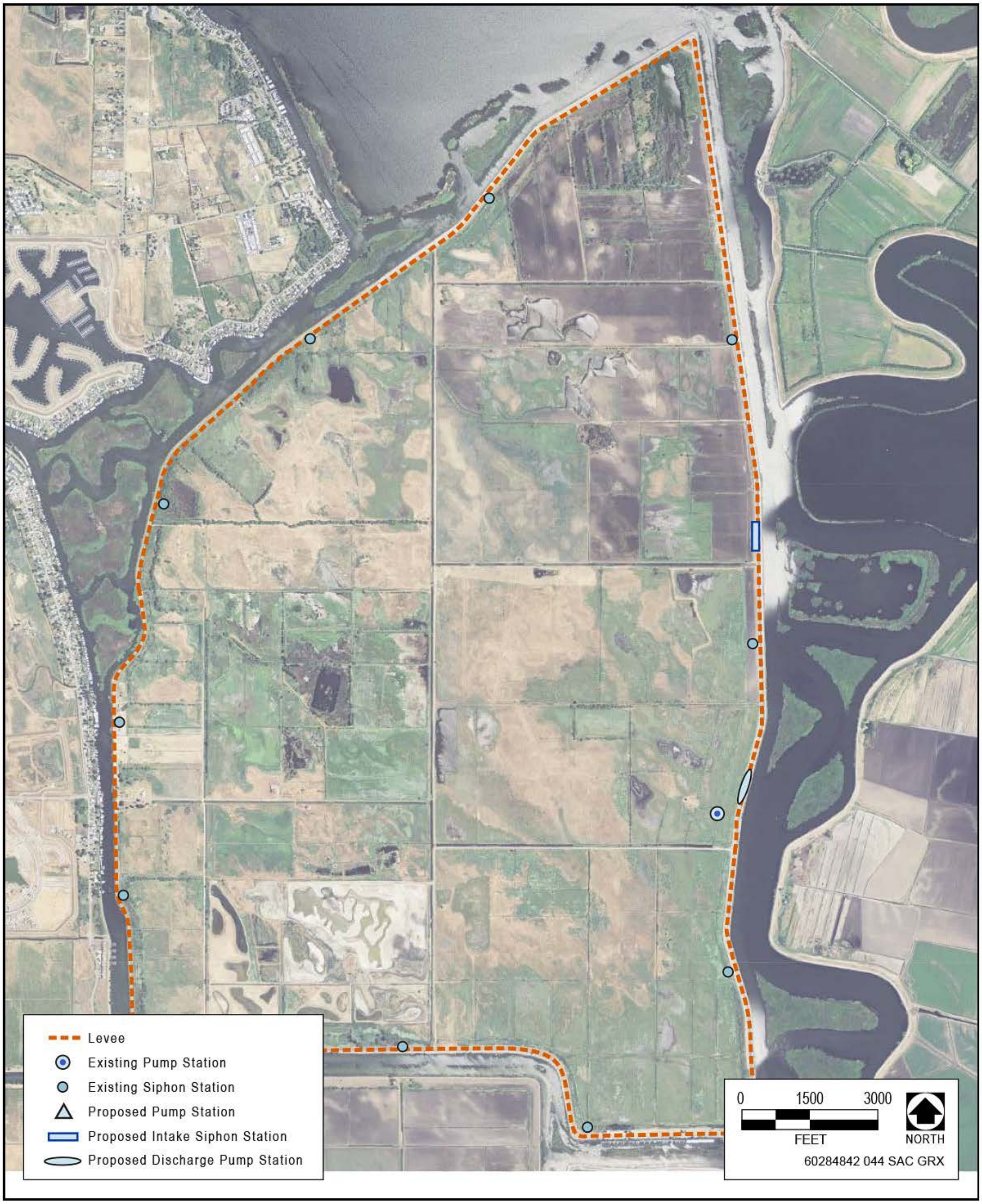
Source: ICF 2000:Chapter 6

Exhibit 2-10 Proposed Seepage Interceptor Well System and Location of Monitoring Piezometers



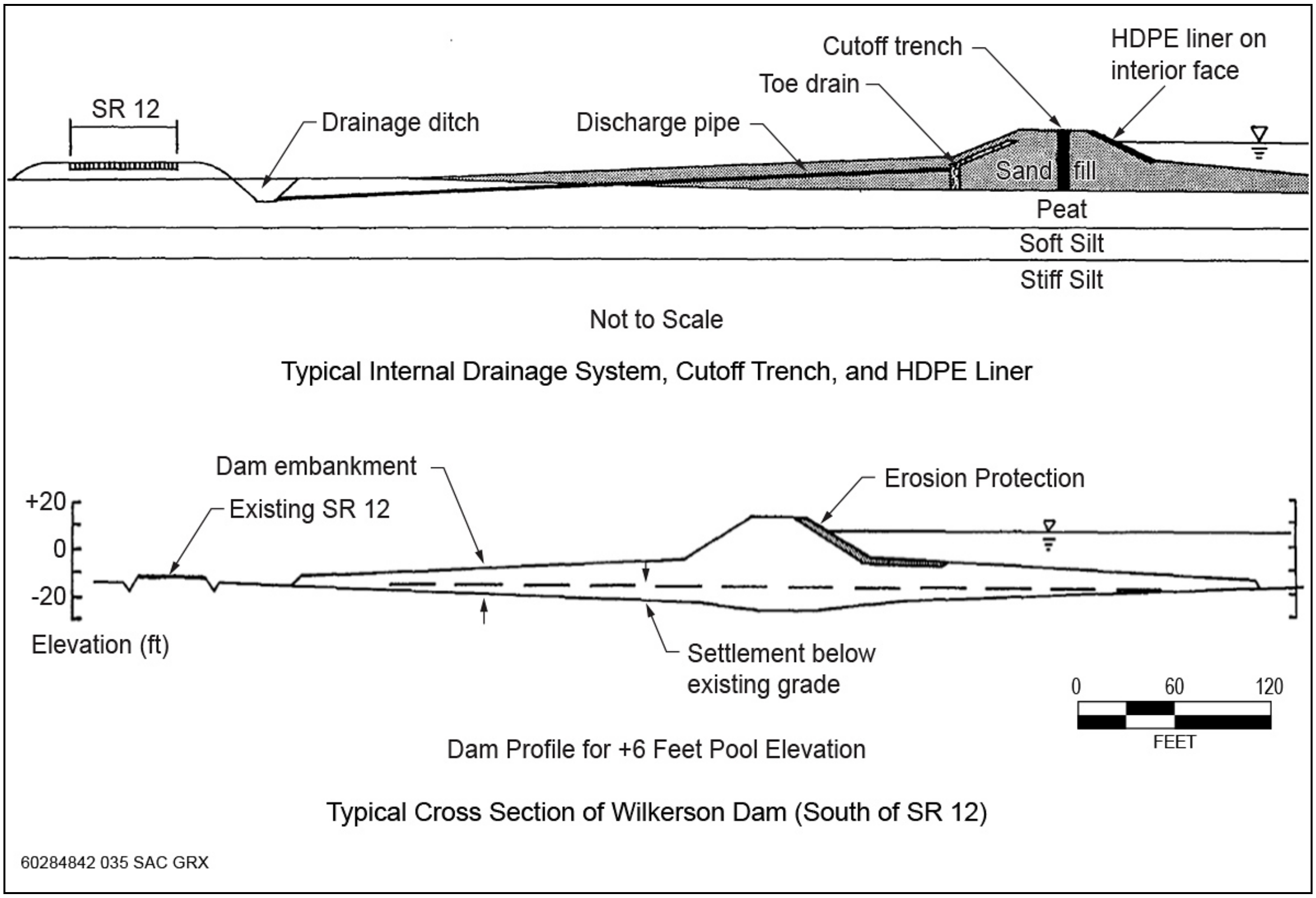
Source: Environmental Science Associates 2014, Adapted by AECOM in 2014

Exhibit 2-11 Proposed Project Facilities on Bouldin Island Under Alternative 3



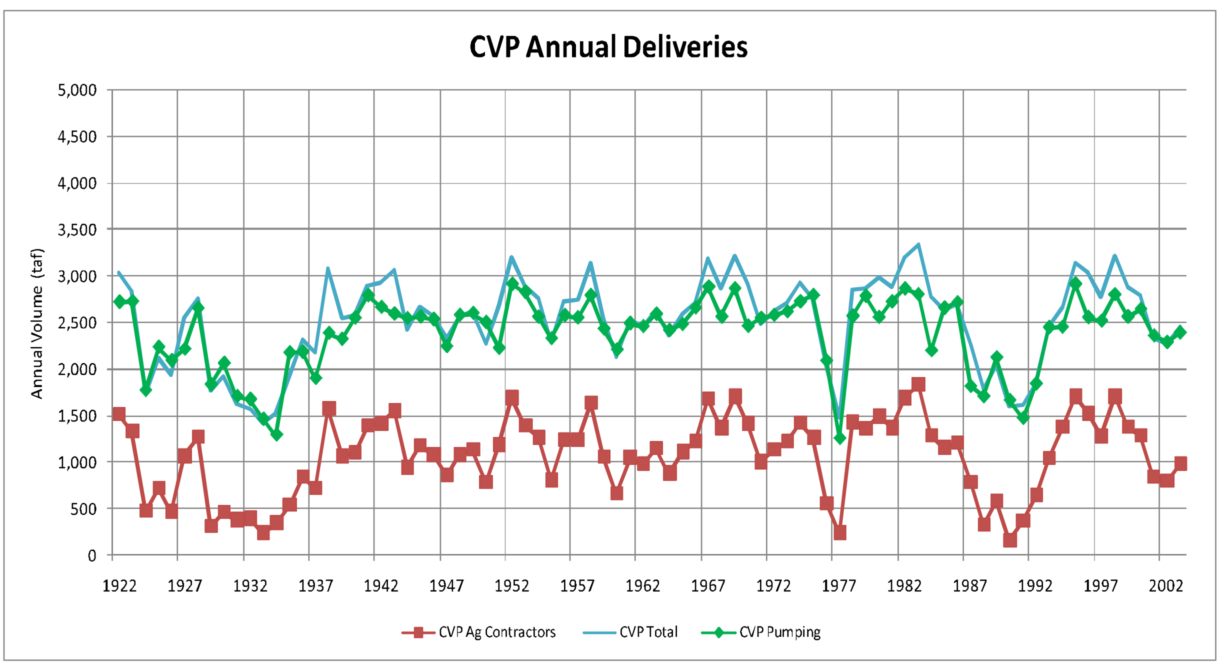
Source: Environmental Science Associates 2014, Adapted by AECOM 2014

Exhibit 2-12 **Proposed Project Facilities on Holland Tract Under Alternative 3**



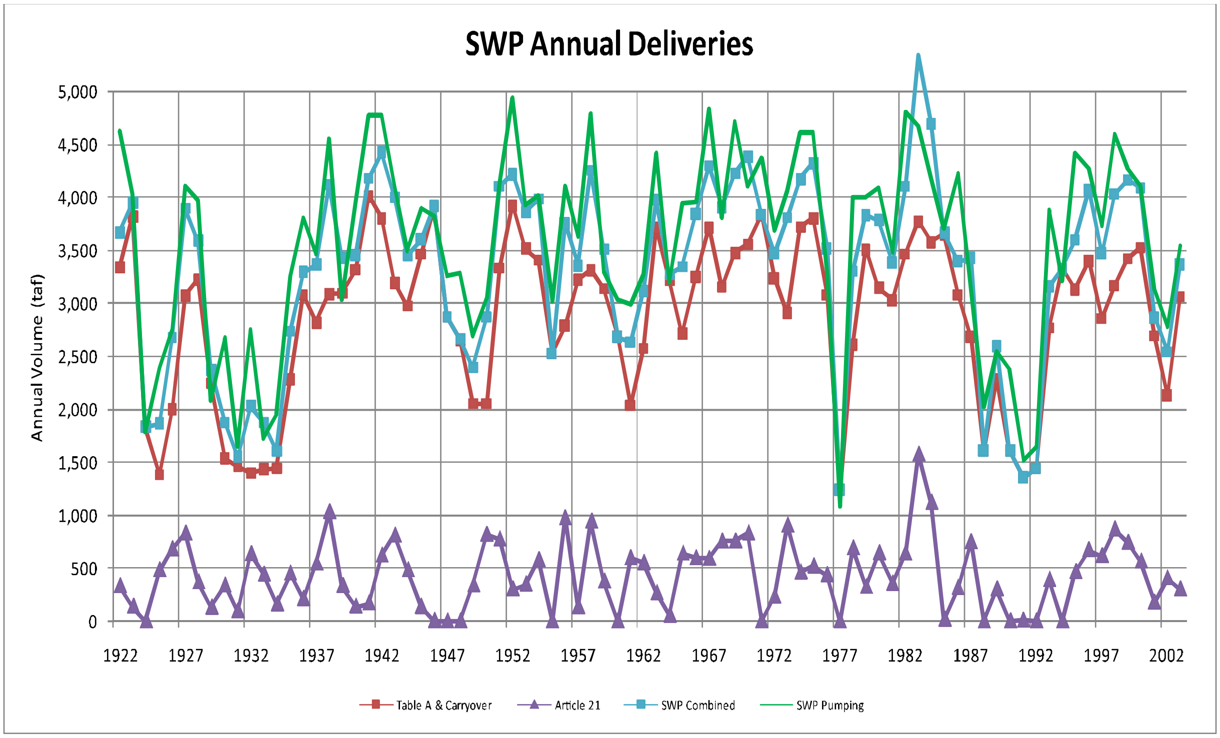
Source: Harding, Lawson Associates 1993 *cited in* ICF 1995:Appendix E1

Exhibit 2-13 **Proposed Wilkerson Dam**



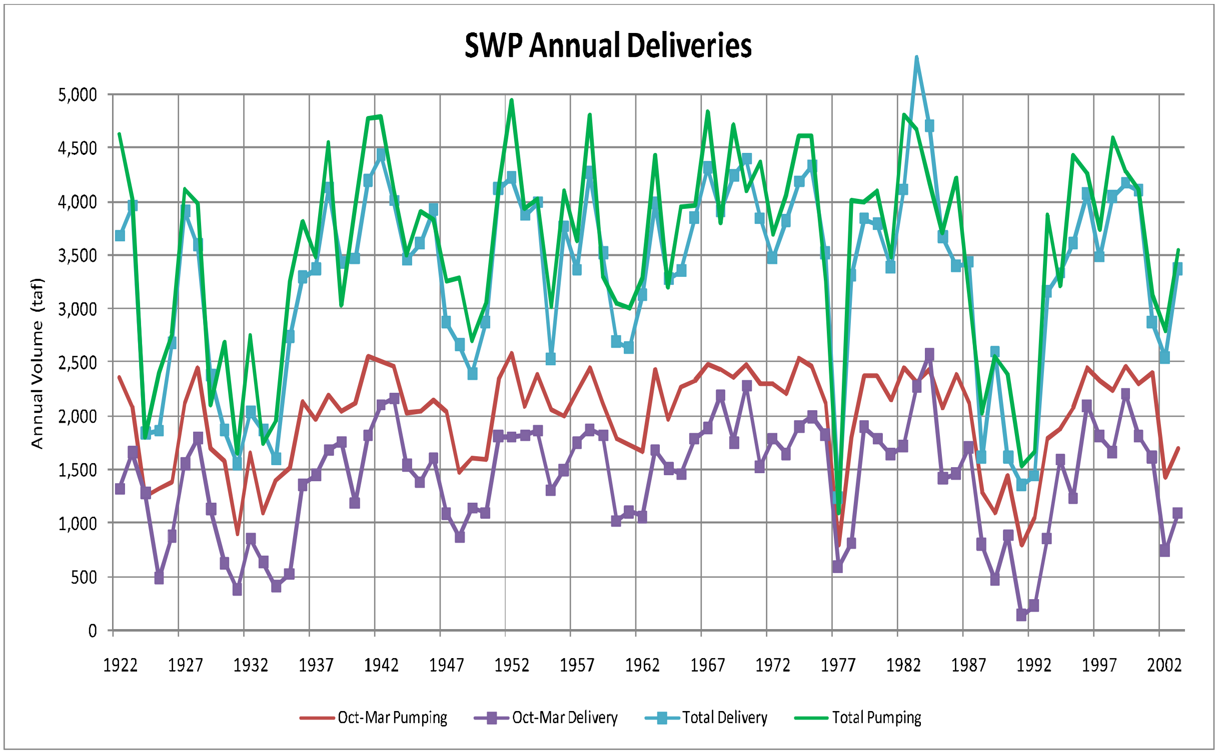
Source: ICF 2010, Adapted by AECOM in 2013

Exhibit 2-14 **CALSIM-Simulated Annual CVP Deliveries (Total and Agricultural) for 1922–2003**



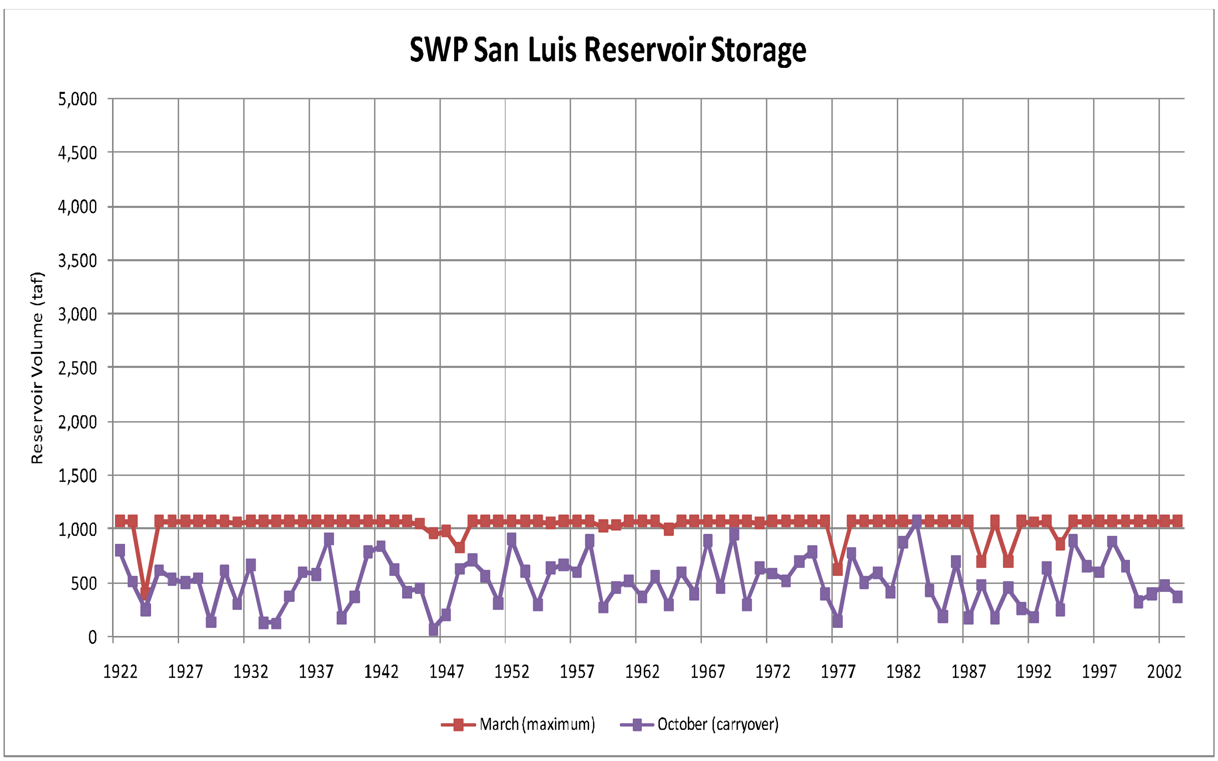
Source: ICF 2010, Adapted by AECOM in 2013

Exhibit 2-15 CALSIM-Simulated Annual SWP Deliveries (Total and Article 21) for 1922–2003



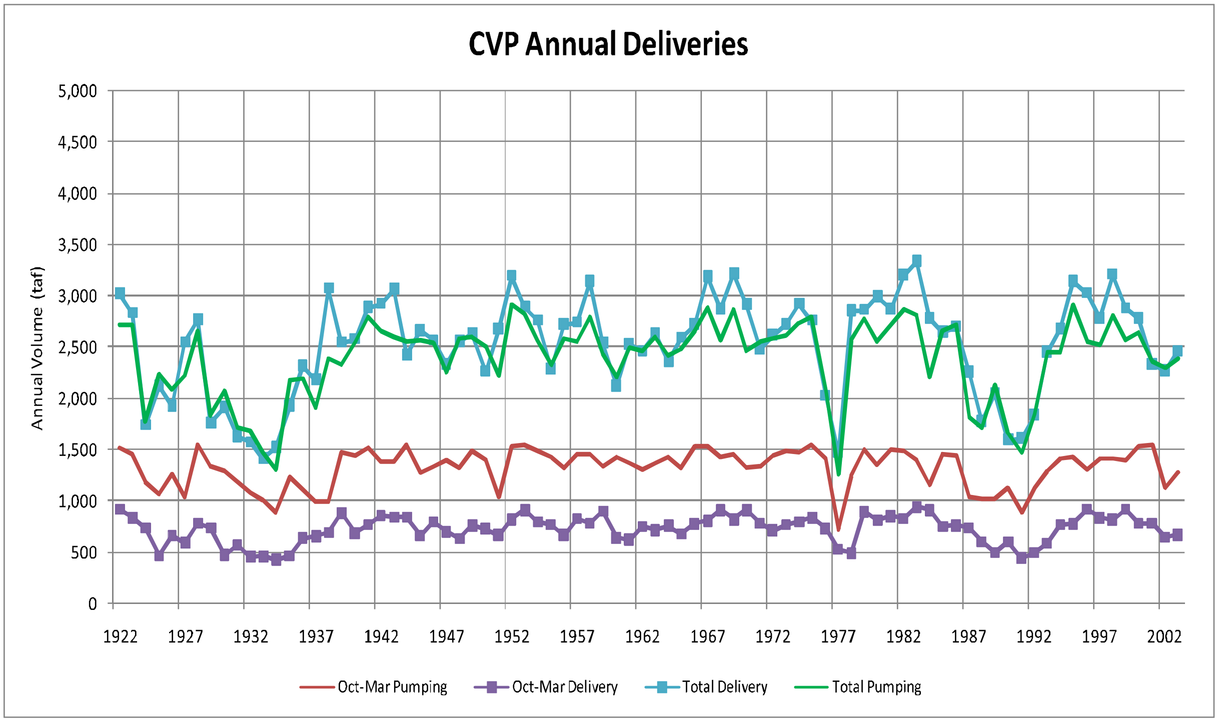
Source: ICF 2010, Adapted by AECOM in 2013

Exhibit 2-16a **CALSIM-Simulated Annual SWP Delivery and Pumping Compared to October–March SWP Delivery and Pumping for 1922–2003**



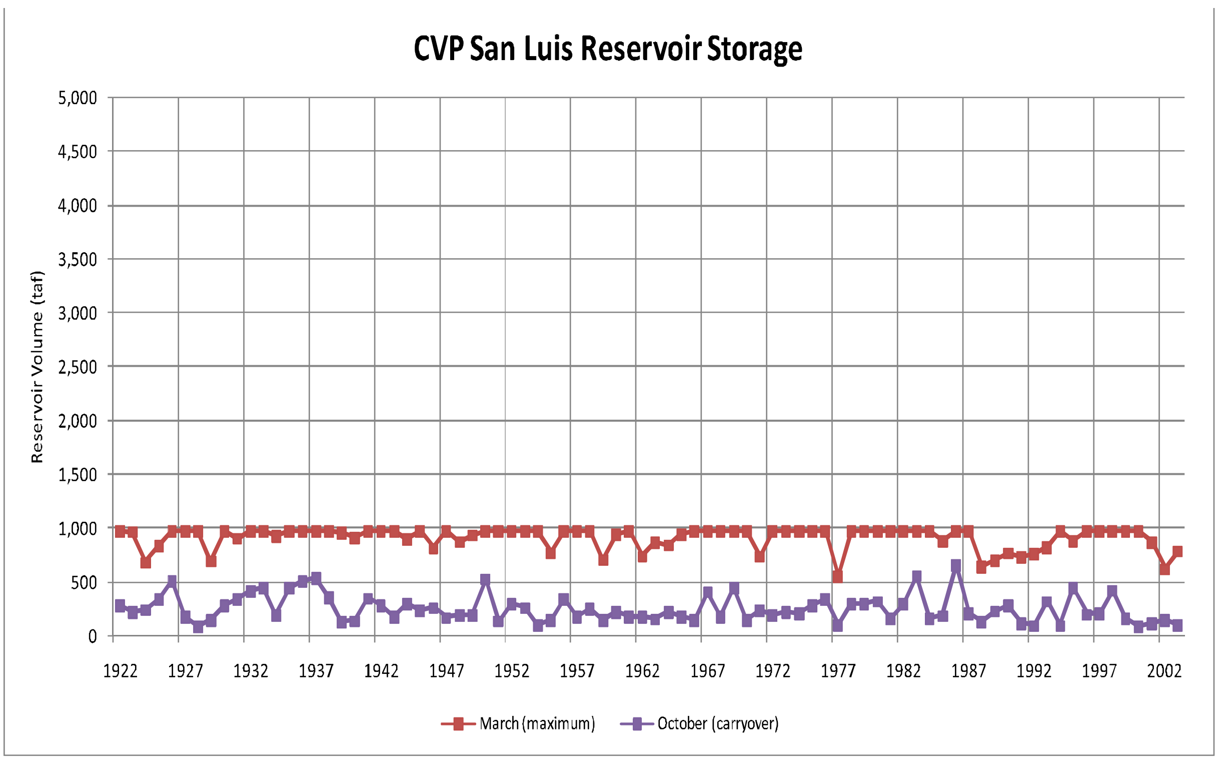
Source: ICF 2010, Adapted by AECOM in 2013

Exhibit 2-16b **CALSIM-Simulated SWP San Luis Reservoir Storage in March and September for 1922–2003**



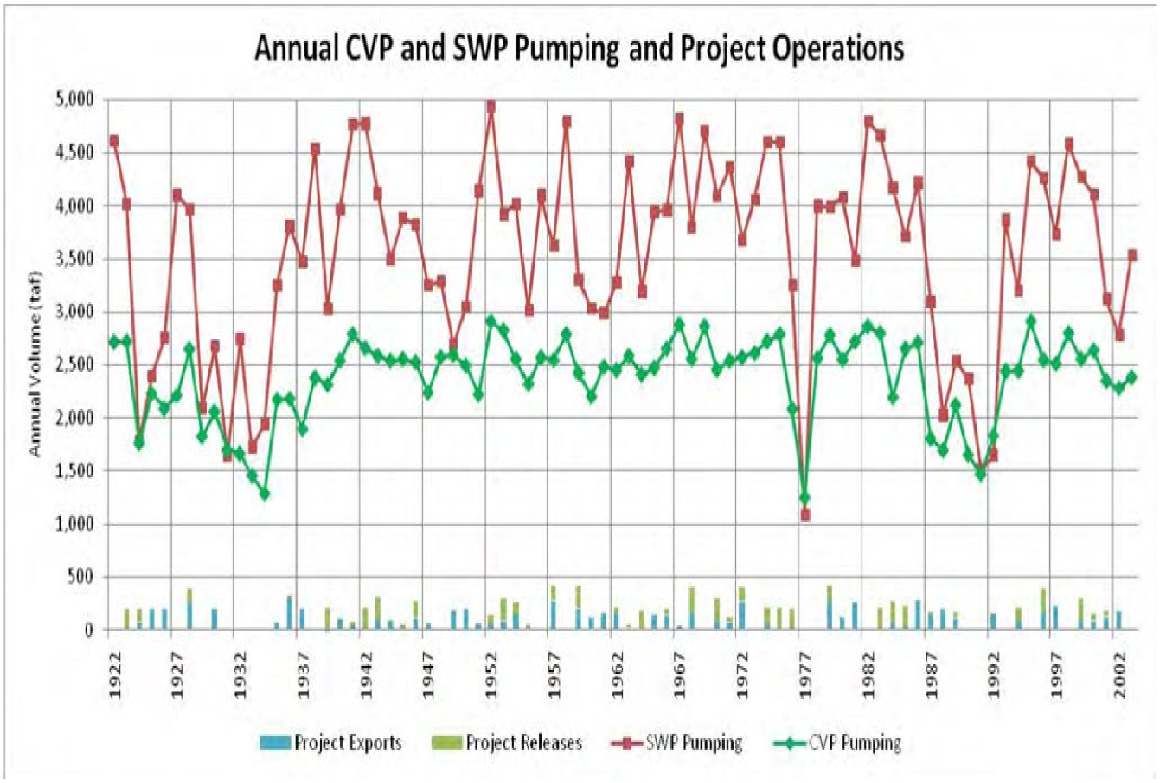
Source: ICF 2010, Adapted by AECOM in 2013

Exhibit 2-17a **CALSIM-Simulated Annual CVP Delivery and Pumping Compared to October–March CVP Delivery and Pumping for 1922–2003**



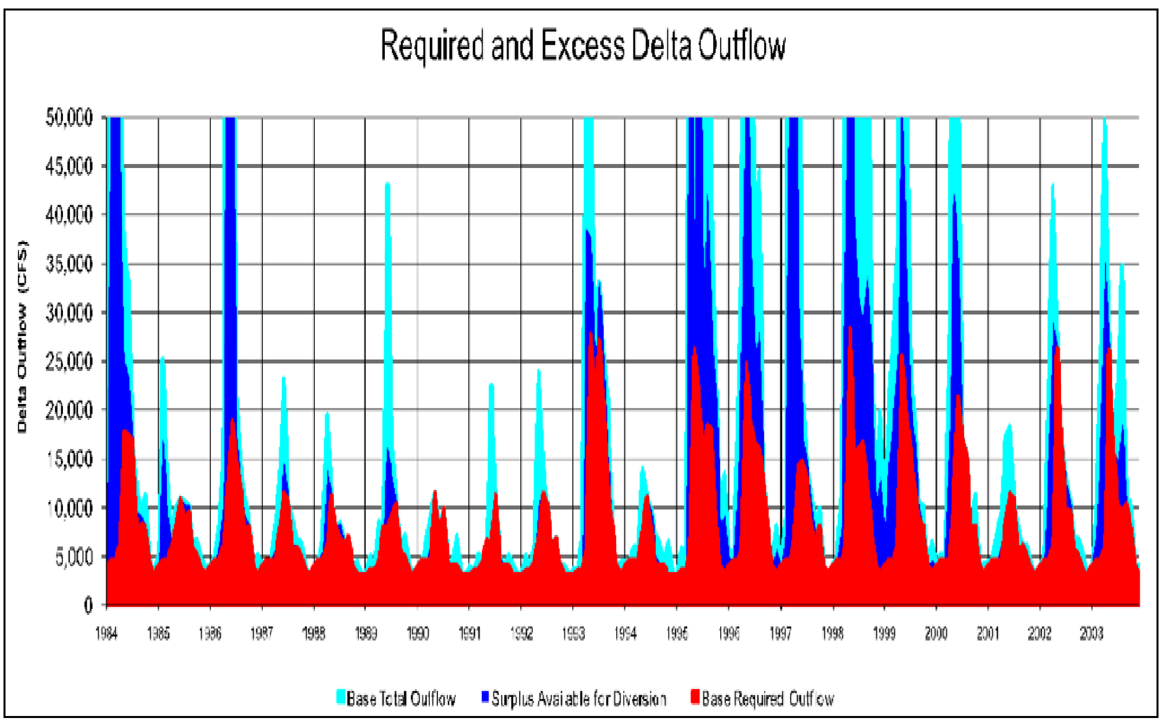
Source: ICF 2010, Adapted by AECOM in 2013

Exhibit 2-17b **CALSIM-Simulated CVP San Luis Reservoir Storage in March and September for 1922–2003**



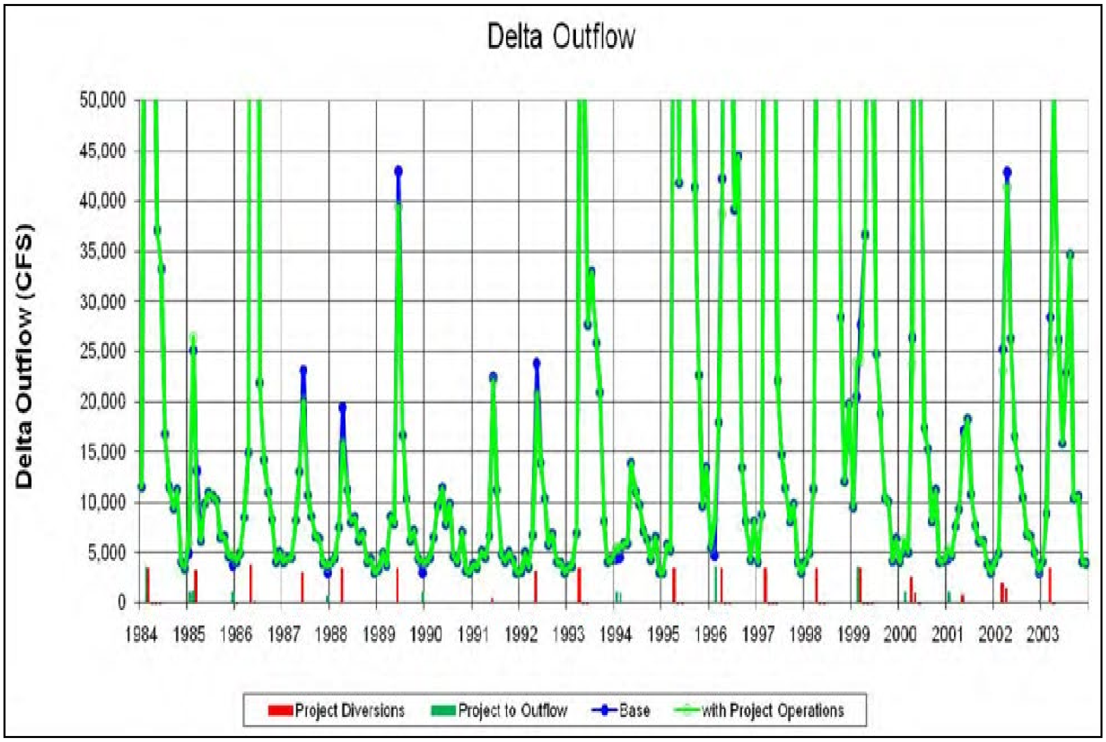
Source: ICF 2010, Adapted by AECOM in 2013

Exhibit 2-18 CALSIM-Simulated CVP and SWP Annual Export Pumping with IDSM-Simulated Project Export Pumping and Releases for Delta Outflow for 1922–2003



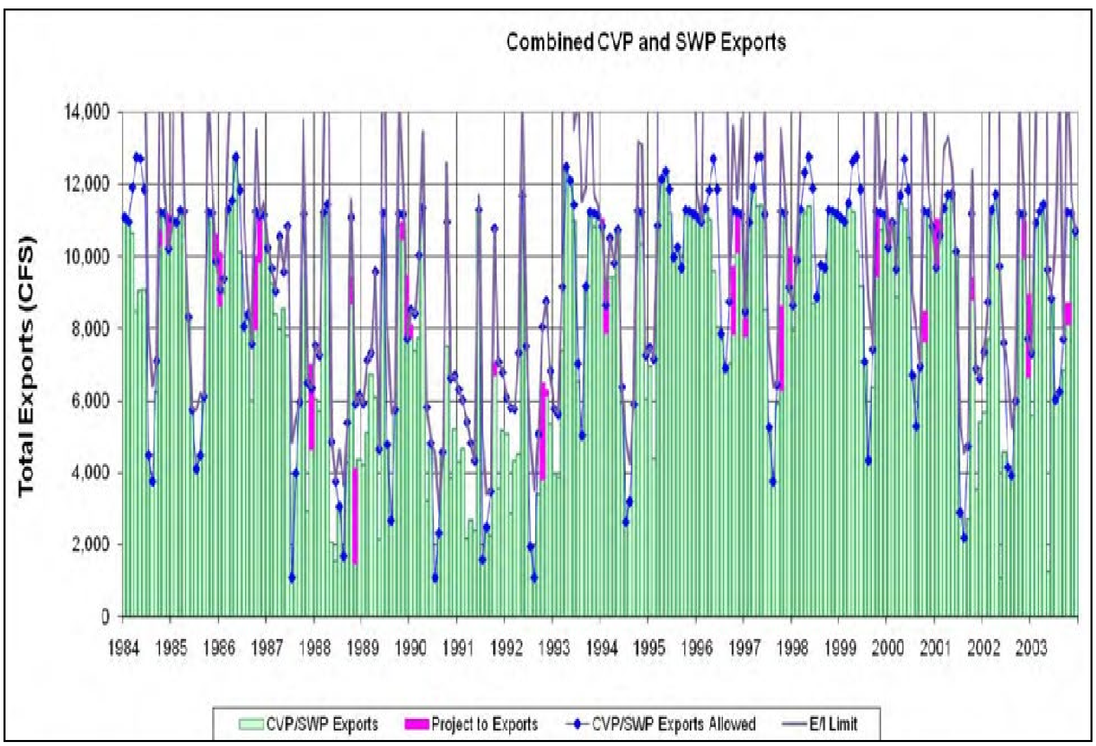
Source: ICF 2010, Adapted by AECOM in 2013

Exhibit 2-19 IDSM-Simulated Delta Outflow with Required Outflow, Surplus Outflow, and Available for Project Diversions (within E/I) for Water Years 1984–2003



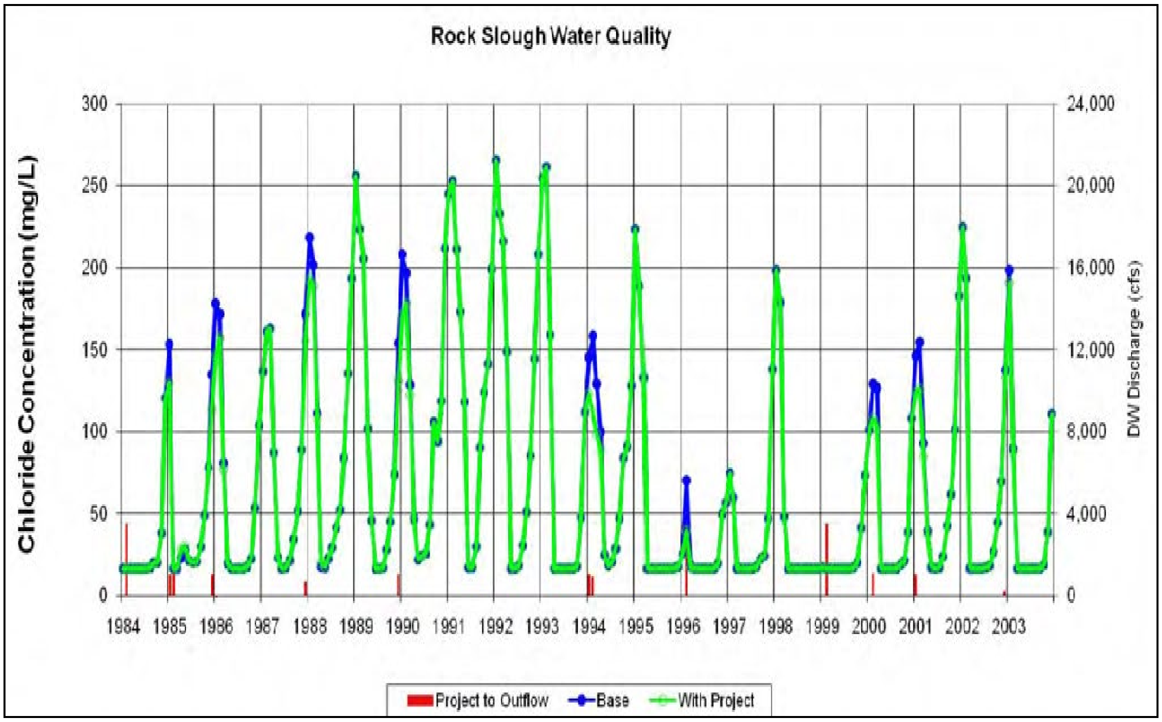
Source: ICF 2010, Adapted by AECOM in 2013

Exhibit 2-20 IDSM-Simulated Delta Outflow with Project Diversions and Project Releases for Increased Delta Outflow for Water Years 1984–2003



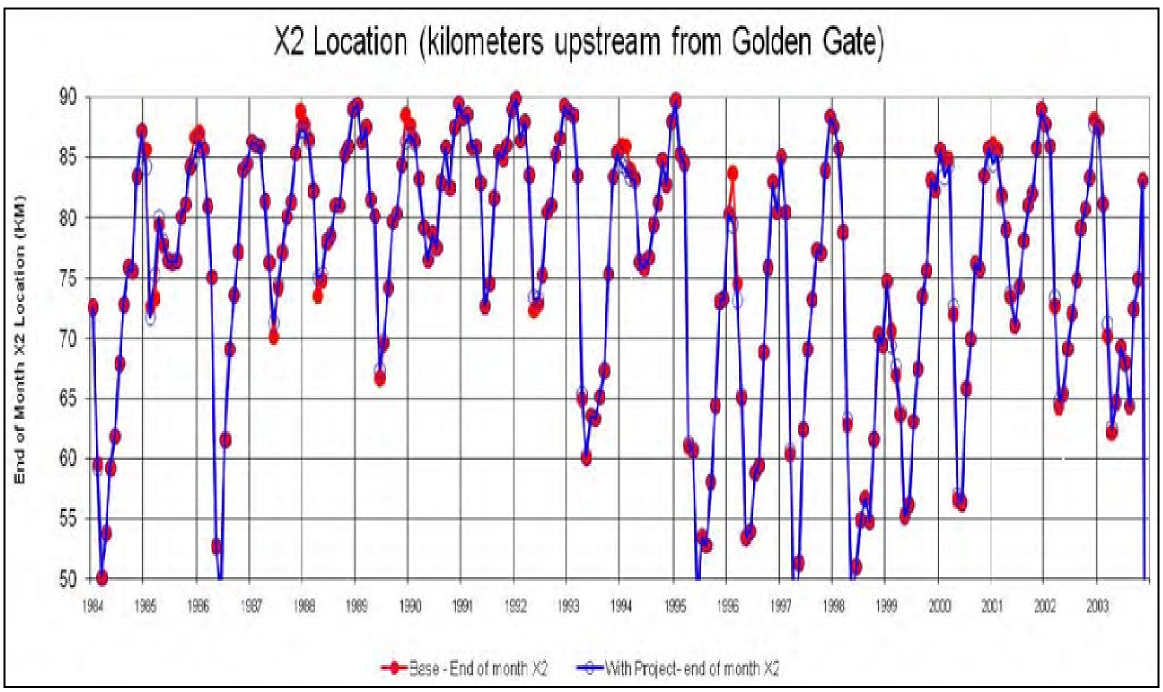
Source: ICF 2010, Adapted by AECOM in 2013

Exhibit 2-21 IDSM-Simulated Combined CVP and SWP Exports with Project Exports for Water Years 1984–2003Note: The allowable exports and the E/I limits are shown for comparison



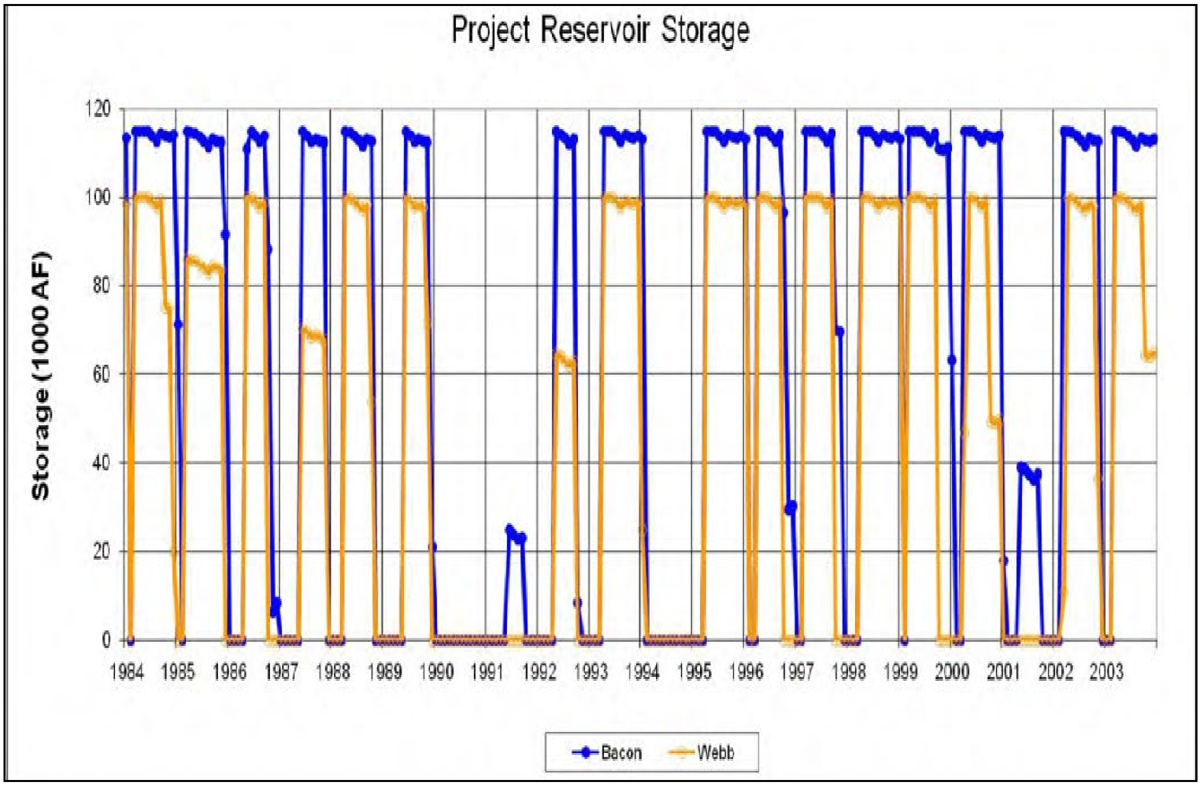
Source: ICF 2010, Adapted by AECOM in 2013

Exhibit 2-22 **IDSM-Simulated CCWD Rock Slough Chloride Concentration with Project Releases for Increased Delta Outflow for Water Years 1984–2003**



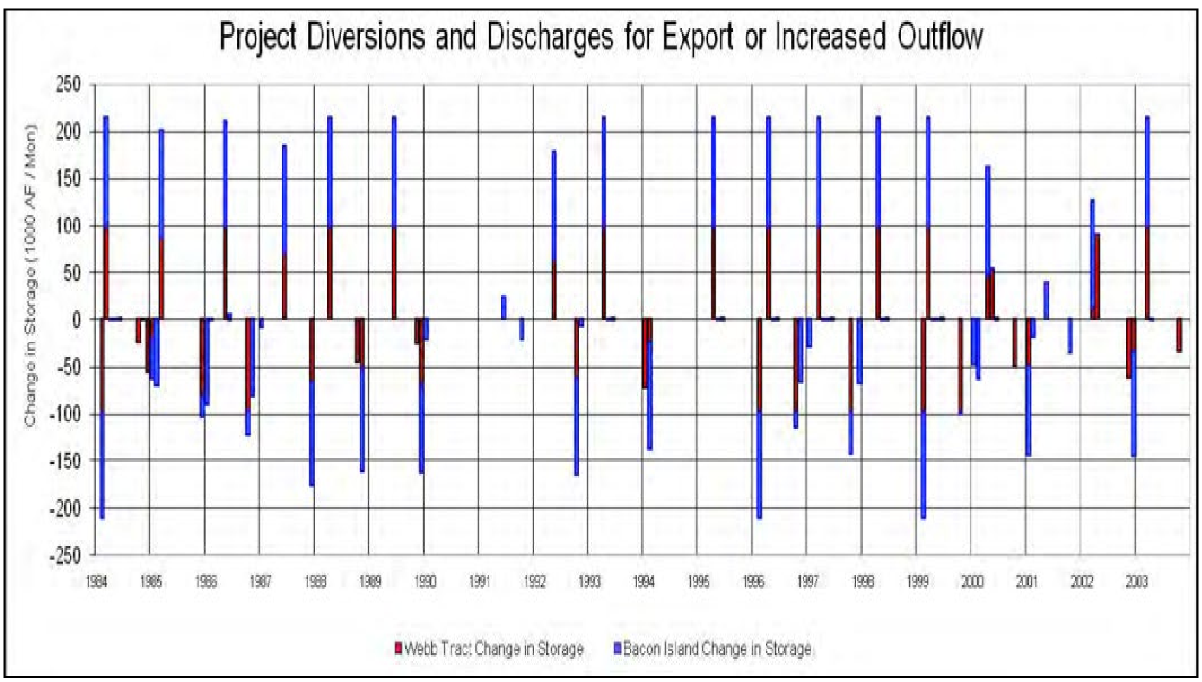
Source: ICF 2010, Adapted by AECOM in 2013

Exhibit 2-23 **IDSM-Simulated End-of-Month X2 Location with Project Diversions and Releases for Increased Delta Outflow for Water Years 1984–2003**



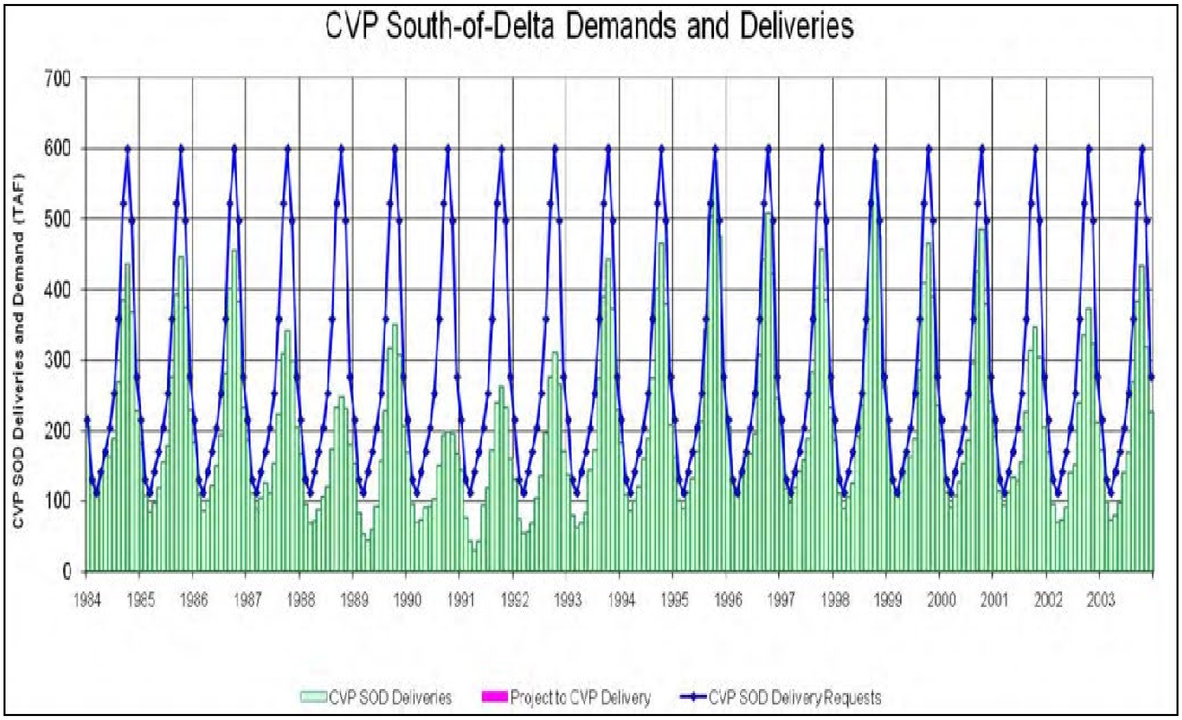
Source: ICF 2010, Adapted by AECOM in 2013

Exhibit 2-24 **IDSM-Simulated Project Reservoir Storage on Bacon Island and Webb Tract for Water Years 1984–2003**



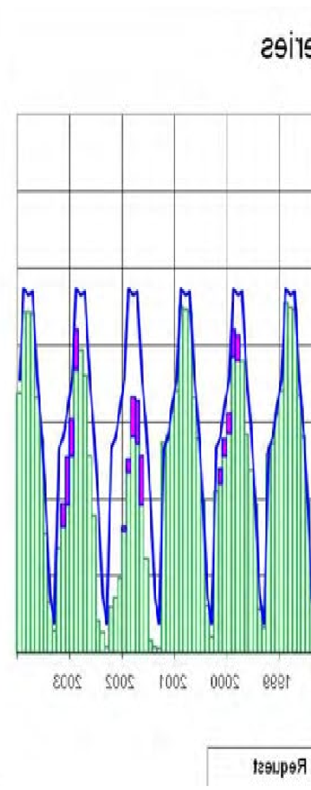
Source: ICF 2010, Adapted by AECOM in 2013

Exhibit 2-25 **IDSM-Simulated Project Diversions or Discharges for Increased Export or Increased Delta Outflow for Water Years 1984–2003**



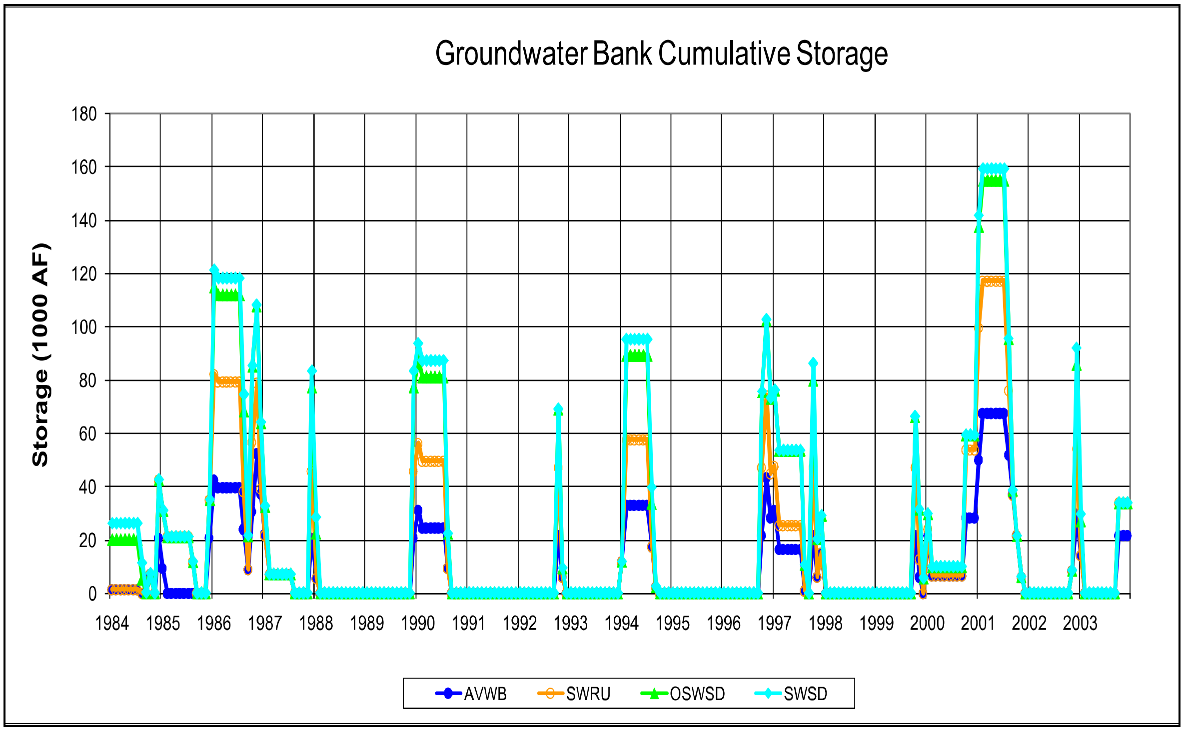
Source: ICF 2010, Adapted by AECOM in 2013

Exhibit 2-26 **IDSM-Simulated CVP South-of-Delta Water Demands and Deliveries with Project Deliveries for Water Years 1984–2003**



Source: ICF 2010, Adapted by AECOM in 2013

Exhibit 2-27 **IDSM-Simulated SWP South-of-Delta Water Demands and Deliveries with Project Deliveries for Water Years 1984–2003**



Source: ICF 2010, Adapted by AECOM in 2013

Exhibit 2-28 IDSM-Simulated Groundwater Bank Storage of Project Water for Water Years 1984–2003

3 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

3.0 APPROACH TO THE ENVIRONMENTAL ANALYSIS AND THE CUMULATIVE CONTEXT

3.0.1 INTRODUCTION

The Council on Environmental Quality (CEQ) regulations for implementing the National Environmental Policy Act (NEPA) (the "NEPA regulations") specify that a Federal agency preparing an environmental impact statement (EIS) must consider the effects of the Proposed Action and alternatives under consideration on the environment; these include effects on ecological, aesthetic, and historical and cultural resources, and economic, social, and health effects. An EIS must also discuss possible conflicts with the objectives of Federal, state, regional, and local adopted land use plans, policies, or controls for the area concerned; energy requirements and conservation potential; urban quality; the relationship between short-term uses of the environment and long-term productivity; and irreversible or irretrievable commitments of resources. An EIS must identify relevant, reasonable mitigation measures that are not already included in the Proposed Action or alternatives under consideration that could avoid, minimize, rectify, reduce, eliminate, or compensate for the project's adverse environmental effects (40 Code of Federal Regulations [CFR] 1502.14, 1502.16, 1508.8).

The following discussion introduces Chapter 3 of this SEIS, which addresses the affected environment, environmental consequences, and mitigation measures for each environmental issue area, and explains the organization and general assumptions used in the analysis. Specific assumptions and methodology and significance criteria (thresholds of significance) used in the analysis and determination and basis of significance of effects are contained in each individual technical section.

3.0.2 SCOPE OF THE ENVIRONMENTAL IMPACT STATEMENT

This SEIS includes an analysis of the following environmental topic areas:

- 3.1 Aesthetics
- 3.2 Agricultural Resources
- 3.3 Air Quality
- 3.4 Aquatic Resources
- 3.5 Biological Resources
- 3.6 Climate Change
- 3.7 Cultural Resources
- 3.8 Environmental Justice
- 3.9 Floodplain Management
- 3.10 Hazardous Waste and Materials
- 3.11 Hydrology and Water Quality
- 3.12 Land Use
- 3.13 Noise
- 3.14 Parks and Recreation
- 3.15 Public Services
- 3.16 Socioeconomics
- 3.17 Traffic and Transportation
- 3.18 Utilities and Service Systems
- 3.19 Water Supply

3.0.3 Section Contents and Definition of Terms

Because this document has been prepared as a supplement, the section contents of each topic area have been organized to present primarily the information that has changed since the 2001 FEIS (herein incorporated by reference) was prepared. Where no changes have occurred, a brief summary of the previous information or effect is presented. Each topical section generally contains the following subsections.

- An introduction that provides a brief explanation of work prepared for prior environmental documents on the Delta Wetlands project and presents an overview of the current section contents.

- A summary of changes, new information, and new circumstances since the 2001 FEIS was prepared.

- A discussion of any changes to the affected environment that have occurred since the 2001 FEIS was prepared and a summary of the previous affected evnivoronment where no changes have occurred.

- A discussion of any changes to the regulatory framework that have occurred since the 2001 FEIS was prepared. Because this SEIS is prepared by a Federal lead agency (i.e., the U.S. Army Corps of Engineers [USACE]), the regulatory framework focuses on Federal laws, regulations, plans and policies that are relevant to the project. However, in certain topic areas where state and/or regional or local laws, regulations, plans and policies have a direct bearing on and relationship to the thresholds of significance, a state and/or regional or local regulatory framework is also presented for informational purposes and to assist with NEPA review.

- The basis for determining the significance of effects for the SEIS effects analysis is based on professional standards, project-specific criteria developed by the lead agency to address potential effects unique to the project's location and elements, and is informed by the criteria contained in the Environmental Checklist in Appendix G of the State CEQA Guidelines. These thresholds encompass the factors taken into account under NEPA to determine the significance of an action in terms of its context and the intensity of its effects. Because this SEIS relies heavily on and incorporates analysis from previous documents (2001 FEIS, 2010 DEIR), it uses a combination of NEPA and CEQA terminology.

- The effect analysis and mitigation measures are presented in order of the alternatives (i.e., No-Action Alternative, Alternative 1, Alternative 2, and Alternative 3) to provide consistency with the prior environmental documents. Alternative 2, however, is the Proposed Action. Any changes to the effects and mitigation measures that have been necessary since publication of the 2001 FEIS are presented and discussed. Where no changes have been necessary, that is so stated, and a brief summary of the previous findings are presented. A table comparing the effect and mitigation measure numbering, titles, and significance conclusions is presented at the end of this subsection to facilitate correlation of this SEIS with the 2001 FEIS.

- USACE, as Federal lead agency over the EIS, has no authority over the enforcement of many of the mitigation measures proposed in this EIS that are not under the purview of USACE. USACE will require as part of issuance of its record of decision (ROD) that the project applicant prepare and implement a mitigation monitoring and reporting program (MMRP). Many of the mitigation measures presented throughout this SEIS have been committed to by the project applicant and have been required as conditions of approval as part of the project's previous project approval and CEQA clearance.

- A discussion of any changes to the cumulative effects that have occurred since the 2001 FEIS was prepared is included. Where no changes have been necessary, that is so stated, and a brief summary of the previous findings are presented. A table comparing the cumulative effect and mitigation measure numbering, titles, and significance conclusions is presented at the end of this subsection to facilitate correlation of this SEIS with the 2001 FEIS. More information related to cumulative effects is described below in Section 3.0.6, "Cumulative Context."

3.0.4 TERMINOLOGY USED TO DESCRIBE EFFECTS

EFFECT LEVELS

The SEIS for this project uses the following terminology to denote the significance of environmental effects of the project.

- **No effect** indicates that the construction, operation, and maintenance of the project would not have any direct or indirect adverse effects on the physical environment. It means no change from existing conditions. This effect level does not need mitigation.

- A **less-than-significant effect** is one that would not result in a substantial or potentially substantial adverse change in the physical environment. This effect level does not require mitigation, even if feasible, under NEPA. In some cases, however, mitigation has been provided to further reduce the effect, although it is not required.

- A **significant effect** is one that would cause a substantial, or potentially substantial, adverse change in any of the physical conditions within the area affected by the project. Under NEPA, mitigation measures must be provided, where feasible, to reduce the magnitude of significant effects.

- A **potentially significant effect** is one that, if it were to occur, would be considered a significant adverse effect as described above; however, the occurrence of the effect cannot be immediately determined with certainty. For NEPA purposes, a potentially significant effect is treated as if it were a significant effect.

- A **significant and unavoidable effect** is one that would result in a substantial or potentially substantial adverse effect on the environment, and that could not be reduced to a less-than-significant level even with implementation of any feasible mitigation.

- A **beneficial effect** is an effect that is considered to cause a positive change or improvement in the environment and for which no mitigation measures are required.

EFFECT MECHANISMS

Mechanisms that could cause effects are discussed for each issue area. General categories of effects mechanisms are construction of the project and activities related to future operations, as described in Chapter 2, “Project Description and Alternatives.”

Project effects fall into the following categories:

- **Direct Effects.** Those effects caused by the action and occurring at the same time and place (40 CFR 1508.8). Because the indirect effects are evaluated in the last subsection of each topic area (e.g., Section 3.1.6, “Secondary and Cumulative Impacts”), all effects that are presented for the No-Action Alternative and Alternatives 1, 2, and 3 are direct effects.

- **Indirect Effects.** Those effects caused by the action and occurring later in time or farther removed in distance, but still reasonably foreseeable. Indirect effects may include growth-inducing effects and other effects related to changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems (40 CFR 1508.8). Indirect effects are evaluated in the last subsection of each topic area (e.g., Section 3.1.6, “Secondary and Cumulative Impacts”).

- **Cumulative Effects.** Those effects on the environment that result from the incremental effect of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency

(Federal or non-Federal) or person undertakes such other actions. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time (40 CFR 1508.7). Cumulative effects encompass the direct and indirect effects attributable to the Proposed Action along with the environmental effects of other past, present, and reasonably foreseeable future actions. Cumulative effects are evaluated in the last subsection of each topic area (e.g., Section 3.1.6, "Secondary and Cumulative Impacts").

The following terms are also used in the effects analysis:

- **Construction** applies to activities associated with ground disturbance, construction of new structures and supporting infrastructure, and the demolition of existing structures and buildings.

- **Operation** applies to activities associated with diverting, storing, and releasing water, along with maintance of project-related facilities.

- **No mitigation is required** is stated in the discussion of mitigation if the effect is considered minimal or less than significant and does not require mitigation.

- **No feasible mitigation is available** is stated in the discussion of mitigation if the effect is considered significant and unavoidable, and there is no feasible mitigation available to fully reduce the magnitude of the effect to a less-than-significant level.

MITIGATION FOR EFFECTS UNDER THE NO-ACTION ALTERNATIVE

As described in Chapter 2, "Project Description and Alternatives," the No-Action Alternative is not simply a continuation of existing conditions. Rather, more intensive agricultural operations would occur, and an intensive for-fee hunting program would be implemented. Thus, in some cases, individual effects under the No-Action Alternative may be significant. However, the No-Action Alternative does meet the definition of a "project" under NEPA and would not require a permit for fill of wetlands; therefore, Delta Wetlands Properties would not be required to implement mitigation measures under the No-Action Alternative regardless of the effect conclusion. The No-Action Alternative is a not a proposal put forth by the project applicant. Therefore, the project applicant is not responsible for implementing mitigation for adverse effects caused by the No-Action Alternative. The No-Action Alternative consists of the effects that could be expected if the 404 permit were not approved by USACE and the project was not implemented.

IMPLEMENTATION OF MITIGATION AND RECORD OF DECISION

If it approves the permit, USACE will adopt an MMRP at the time that it issues the ROD that will reflect USACE's final decision, the rationale behind the decision, and a commitment to monitoring and mitigation. According to Section 1505.2 of the NEPA regulations adopted by the CEQ, the ROD must do all of the following:

a) State what the decision was.

b) Identify all alternatives considered by the agency in reaching its decision, specifying the alternative or alternatives which were considered to be environmentally preferable. An agency may discuss preferences among alternatives based on relevant factors including economic and technical considerations and agency statutory missions. An agency shall identify and discuss all such factors including any essential considerations of national policy which were balanced by the agency in making its decision and state how those considerations entered into its decision.

c) State whether all practicable means to avoid or minimize environmental harm from the alternative selected have been adopted, and if not, why they were not. A monitoring and enforcement program shall be adopted and summarized where applicable for any mitigation.

3.0.5 Topics With Less-Than-Significant or No Effects

Energy Conservation and Development

Energy resources that would be used as part of the project would be minimal, and would consist of gasoline and diesel fuel used to power equipment to make repairs to the existing levees, to install water diversion structures in the Delta, and for a small amount of construction worker vehicle trips and construction material transport trips. Fossil fuels are currently used to operate equipment involved with agricultural operations on the four project islands, and such fossil fuels have continuously been used for farming on the islands for the last 100 years. If the project is not implemented, yearly fossil fuel use for agricultural equipment would continue. In contrast, implementation of the project would result in a 2-3 year period of energy consumption by equipment used during the construction phase, and then a minimal use of fuels to operate the project. Because the water storage islands are already located in the middle of the Delta channels where the water is present, because the project islands already have existing levees that would function as berms to impound the water, and because the facilities to transport water to the groundwater banks are already in place, the project would be energy efficient as compared to a water storage project that would be located inland. Therefore, effects associated with energy conservation and development would be less than significant.

Geology, Soils, Seismic, and Minerals

This section was not included in the SEIS for the following reasons. Portions of three of the four project islands are located over natural gas fields, but project construction and operation would not interfere with the ability of any entity to extract natural gas; thus, the mineral resource effects would be less than significant. The project islands are not located in a seismically active area; thus, the seismic effects would be less than significant. The only geology and soils effects relate to proposed levee strengthening activities on the project islands, in terms of subsidence, underseepage, and overtopping. Those topics are evaluated in Section 3.9, “Floodplain Management.”

Navigation, Shore Erosion and Accretion, Coastal Zones, and Marine Sanctuaries

Project-related effects on boating in Delta waterways (pertaining to navigation) are addressed in Section 3.17, “Traffic and Transportation.” Project-related effects on erosion of Delta channels from releases of water stored on the project islands are addressed in Section 3.11, “Hydrology and Water Quality.” The project does not pertain to coastal zones or marine sanctuaries.

Paleontological Resources

A paleontological resources section was not included because all four project islands are composed of Holocene-age (i.e., 11,700 years Before Present and younger) intertidal deposits and/or Holocene dune sand. Holocene deposits contain only the remains of extant, modern taxa (if any resources are present), which are not considered unique paleontological resources; thus, there would be no effect.

3.0.6 Cumulative Context

Introduction to the Cumulative Analysis

This SEIS provides an analysis of overall cumulative effects of the Delta Wetlands project considered along with other past, present, and reasonably foreseeable future projects under NEPA implementing regulations (40 CFR 1508.7). The purpose of this analysis is twofold: first, to determine whether the overall long-term effects of all such projects would be cumulatively significant and second, to determine whether Delta Wetlands project itself would cause a “cumulatively considerable” (and thus significant) *incremental* contribution to any such cumulatively significant effects. In other words, the required analysis first creates a broad context in which to assess the project’s incremental contribution to anticipated cumulative effects. The analysis then determines whether the project's incremental contribution to any significant cumulative effects from all projects is itself significant (i.e., "cumulatively considerable").

CEQ regulations implementing provisions of NEPA define cumulative effects as "the effect on the environment which results from the incremental effect of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions" (40 CFR 1508.7). Cumulative effects can result from individually minor, but collectively significant, actions over time (40 CFR 1508.8). They are caused by the incremental increase in total environmental effects when the evaluated project is added to other past, present, and reasonably foreseeable future actions. Cumulative effects can thus arise from causes that are totally unrelated to the project being evaluated, and the analysis of cumulative effects looks at the life cycle of the effects, not the project at issue.

LIST OF CUMULATIVE PROJECTS

The past, present, and probable future projects that were used for the cumulative analysis in the 2001 FEIS are listed in Table 3.0-1.

Because so much time has passed since the cumulative effects analysis was performed for the 2001 FEIS, the list of programs and projects shown in Table 3.0-1 is largely out of date. Scoping for this SEIS and the list of cumulative projects contained in the 2010 DEIR was used to update the list of projects considered in the revised cumulative effect analysis for this SEIS. The analysis considers projects that could affect the same resources and, where relevant, in the same time frame as the Delta Wetlands project. Table 3.0-2 lists the projects considered for the updated cumulative effects analysis in this SEIS. A description of each program or project considered for this SEIS is discussed following the table. Table 3.0-2 is not intended to be an all-inclusive list of projects in the region, but rather focuses on those water management actions or projects that, when combined with the Delta Wetlands project, could contribute to cumulative effects.

Middle River Intake and Pump Station Project

Contra Costa Water District's (CCWD) Middle River Intake and Pump Station Project consists of a new 250 cubic feet per second (cfs) screened intake at Victoria Canal and a pump station; levee improvements; and a conveyance pipeline to CCWD's existing conveyance facilities. CCWD will operate the intake and pipeline together with its existing facilities to better meet its delivered water quality goals and to better protect listed species. Operations with the project will be similar to existing operations: CCWD will deliver Delta water to its customers by direct diversion when salinity at its intakes is low enough, and will blend Delta water with releases from Los Vaqueros Reservoir when salinity at its intakes exceeds the delivered water quality goal. Los Vaqueros Reservoir will be filled from the existing Old River intake or the new Victoria Canal intake during periods of high flow in the Delta, when Delta salinity is low. The choice of which intake to use at any given time will be based in large part upon salinity, consistent with fish protection requirements in the biological opinions; salinity at the Victoria Canal intake site is at times lower than salinity at the existing intakes. The no-fill and no-diversion periods will continue as part of CCWD operations, as will monitoring and shifting of diversions among the four intakes to minimize effects on listed species.

The project is a water quality project and will not increase CCWD's average annual diversions from the Delta. However, it will alter the timing and pattern of CCWD's diversions in two ways: winter and spring diversions will decrease while late summer and fall diversions will increase because Victoria Canal salinity tends to be lower in the late summer and fall than salinity at CCWD's existing intakes; and diversions at the unscreened Rock Slough Intake will decrease while diversions at screened intakes will increase. It is estimated that with the AIP, Rock Slough intake diversions will fall to about 10% of CCWD's total diversions, with the remaining diversions taking place at the other screened intakes.

Table 3.0-1
List of Cumulative Projects Considered in the 2001 FEIS

List of Cumulative Projects Considered in the 2001 FEIS
State Water Board Bay-Delta Proceedings
CALFED Bay-Delta Program
CVP and SWP Endangered Species Consultations
Coordinated Operations Agreement
Banks Pumping Plant Fish Protection Agreement
Central Valley Project Improvement Act
DWR Delta Water Management Programs ► North Delta Program ► South Delta Program ► West Delta Program
DWR Delta Levee Maintenance Program ► Subventions Program ► Special Projects
Delta Ecological Studies
DWR Offstream Storage South of the Delta ► Los Banos Grandes ► Kern Water Bank
SWP Coastal Branch Project, Phase II
CCWD Los Vaqueros Project
Montezuma Wetlands Project
Delta Water Transfers
Reoperation of Folsom Dam and Reservoir
East Bay Municipal Utility District Activities ► American River Diversions ► Water Supply Management Program
Activities of the Metropolitan Water District of Southern California ► Arvin-Edison/Metropolitan Water District Storage and Exchange Program ► Domenigoni Reservoir Project
Source: ICF 2010: 5-2 and 5-3; adapted by AECOM in 2013

Table 3.0-2 List of Cumulative Projects Considered in this SEIS
Middle River Intake and Pump Station Project
Bay Area Water Quality and Water Supply Reliability Program
Bay Delta Conservation Plan, California Water Fix, and California EcoRestore
CALFED Ecosystem Restoration Program
CALFED Levee System Integrity Program
City of Stockton Delta Water Supply Project
Clifton Court Forebay–Jones Pumping Plant Intertie
Delta Cross Channel Reoperation and Through-Delta Facility
Delta-Mendota Canal–California Aqueduct Intertie
Dutch Slough Tidal Marsh Restoration Project
Franks Tract Project
Freeport Regional Water Project
Ironhouse Sanitary District Wastewater Treatment Plant Expansion
Level 2 Federal Refuge Water Supply Program
Liberty Island Conservation Bank
Los Vaqueros Reservoir Expansion
Lower San Joaquin River Flood Improvements
Monterey Plus (Monterey Amendment to the State Water Project Contracts)
Mountain House Community
National Marine Fisheries Service Biological Opinion Reasonable and Prudent Alternative for Central Valley Project/State Water Project OCAP
North Bay Aqueduct Alternative Intake Project
North Delta Flood Control and Ecosystem Restoration Project
North-of-Delta Off-Stream Storage (Sites Reservoir)
Old River and Rock Slough Water Quality Improvement Project
Red Bluff Diversion Dam Fish Passage Improvement Project
River Islands at Lathrop Development
Sacramento Valley Water Management Settlement Agreement (Phase 8)
Sacramento River Deep Water Ship Channel Deepening Project
San Joaquin River Restoration Program
San Luis Reservoir Low Point Improvement Project
Shasta Dam and Reservoir Enlargement
South Bay Aqueduct Enlargement
South Bay Salt Pond Restoration Project
South Delta Improvements Program
State Water Project—Oroville Facilities

Table 3.0-2 List of Cumulative Projects Considered in this SEIS
Stockton Deep Water Ship Channel
Suisun Marsh Management Plan
SWP Harvey O. Banks Pumping Plant Operations
Upper San Joaquin River Basin Storage
U.S. Fish and Wildlife Service Biological Opinion Reasonable and Prudent Alternative for Central Valley Project/State Water Project OCAP
Projects in Contra Costa General Plan
Projects in San Joaquin County General Plan
Source: ICF 2010: 5-3 through 5-6; adapted by AECOM in 2013

The project was initiated in July 2004 with a 2-year planning phase that included an environmental analysis to comply with Federal and state requirements (NEPA and CEQA). CCWD and Reclamation released the Draft EIR/EIS in May 2006 and the Final EIR/EIS in October 2006. In November 2006, the CCWD Board of Directors approved the project and certified the EIR. The project became operational in 2010. Significant effects identified in the project EIR/EIS consisted of air quality and loss of agricultural land. Additional information is provided at: <http://www.ccwater.com/aip.asp>.

Bay Area Water Quality and Water Supply Reliability Program

The Bay Area Water Quality and Water Supply Reliability Program would encourage participating Bay Area partners, including Alameda County Water District, Zone 7 Water Agency, Bay Area Water Supply and Conservation Agency, CCWD, East Bay Municipal Utility District (EBMUD), San Francisco Public Utilities Commission, and the Santa Clara Valley Water District (SCVWD), to develop and coordinate regional exchange projects to improve water quality and supply reliability. This program would include the cooperation of these agencies in operating their water supplies for the benefit of the entire Bay Area region as well as the potential construction of interconnects between existing water supplies. This program is in the planning stages.

Bay Delta Conservation Plan, California WaterFix, and California EcoRestore

The Bay Delta Conservation Plan (BDCP) is a plan to provide for the recovery of Endangered, Threatened, and sensitive species and their habitats in the Delta in a way that also will protect and restore water supplies. The BDCP would identify and implement conservation strategies to improve the overall ecological health of the Delta; identify and implement ecologically friendly ways to move freshwater through and/or around the Delta; address toxic pollutants, invasive species, and impairments to water quality; and provide a framework and funding to implement the plan over the next 50 years. The BDCP is being prepared through a collaborative process among state, Federal, and local water agencies (e.g., DWR, Reclamation, Westlands Water District); state and Federal fish agencies (U.S. Fish and Wildlife Service [USFWS], California Department of Fish and Wildflie [DFW], and National Marine Fisheries Service [NMFS]); environmental organizations (e.g., The Nature Conservancy, Defenders of Wildlife); other Federal agencies (U.S. Environmental Protection Agency [EPA] and USACE); and other interested parties.

The BDCP proposes to construct new intakes on the Sacramento River connected to one or more conveyance facilities that would extend south to existing SWP and CVP export systems. Alternatives currently being evaluated comprise the following conveyance options: through-Delta; east alignment (tunnel and canal); west alignment (tunnel and canal); all-tunnel; or dual conveyance (combines portions of east, west, or all-tunnel alignments with some elements of through-Delta alignment) (Delta Habitat Conservation and Conveyance

Program 2009). The restoration options include various degrees of restoration in the Delta and Suisun Marsh. Overall, it could contribute to a more stable water supply, improved levee stability, and reduced effects on fish. The BDCP public review draft and its accompanying EIS/EIR was released for public review and comment in 2013. The available documentation and summary of deliberations, including the Draft EIR/EIS, are available on the following BDCP website: http://baydeltaconservationplan.com/2013-2014PublicReview/2013-2014PublicReviewInformationalMaterials.aspx.

Since the Public Draft EIR/EIS was released, state and Federal agencies have proposed a new sub-alternative—Alternative 4A—which would replace Alternative 4 (the proposed BDCP) as the state's proposed project. Alternative 4A reflects the state's proposal to separate the conveyance facility and habitat restoration measures into two separate efforts: California WaterFix and California EcoRestore. These two efforts are a direct reflection of BDCP public comments and also fulfill the requirement of the 2009 Delta Reform Act to meet co-equal goals. Alternative 4A will be evaluated in a future Recirculated Draft EIR/Supplemental Draft EIS. The California Water Fix and California EcoRestore plans include key elements of BDCP, including north-of-Delta diversion structures and approximately 30,000 acres of habitat restoration in the Delta over the next 5 years. (It should be noted that the Delta Wetlands project is located in the Central Delta, which is not the area that would be targeted for restoration by BDCP.)

The BDCP project could contribute to cumulative effects on fish, water supply, hydrodynamics, and loss of agricultural land. It could also contribute beneficially to habitat improvements for fish and estuarine species in the Delta.

CALFED Ecosystem Restoration Program

The goals of the CALFED Ecosystem Restoration Program (ERP) are to:

- recover 19 at-risk native species and contribute to the recovery of 25 additional species;
- rehabilitate natural processes related to hydrology, stream channels, sediment, floodplains and ecosystem water quality;
- maintain and enhance fish populations critical to commercial, sport, and recreational fisheries;
- protect and restore functional habitats, including aquatic, upland, and riparian, to allow species to thrive;
- reduce the negative effects of invasive species and prevent additional introductions that compete with and destroy native species; and
- improve and maintain water and sediment quality to better support ecosystem health and allow species to flourish.

The ERP plan, which is now administered and funded by DFW, is divided into the Sacramento, San Joaquin, and Delta and Eastside Tributary regions. This plan includes the following kinds of actions:

- develop and implement habitat management and restoration actions, including restoration of river corridors and floodplains, reconstruction of channel-floodplain interactions, and restoration of Delta aquatic habitats;
- restore habitat that would specifically benefit one or more at-risk species;
- implement fish passage programs and conduct passage studies;
- continue major fish screen projects and conduct studies to improve knowledge of their effects;

- restore geomorphic processes in stream and riparian corridors;
- implement actions to improve understanding of at-risk species;
- develop understanding and technologies to reduce the effects of irrigation drainage on the San Joaquin River and reduce transport of contaminant (selenium) loads carried by the San Joaquin to the Delta and the Bay; and
- implement actions to prevent, control, and reduce effects from nonnative invasive species.

ERP actions contribute to cumulative benefits on fish and wildlife species, habitats, and ecological processes. Many of the Delta ERP actions will be included in the BDCP planning and design process.

CALFED Levee System Integrity Program

The Levee System Integrity Program is being implemented by the California Department of Water Resources (DWR), DFW, and USFWS. The goal of the CALFED Levee System Integrity Program is to uniformly improve Delta levees by modifying cross sections, raising levee height, widening levee crown, flattening levee slopes, or constructing stability berms. Estimates are that 520 miles of levees need improvement and maintenance to meet the PL 84-99 standard for Delta levees. The levee program continues to implement levee improvements throughout the Delta, including the south Delta area.

This program could contribute to cumulative effects on fish, geology and soils, cultural resources, and water quality. It would be considered cumulatively beneficial for water supply because improving Delta levee stability is needed to ensure that Delta waterways are a reliable means for conveying water for in-Delta and export purposes.

City of Stockton Delta Water Supply Project

This completed project was implemented to divert water from the San Joaquin River for use as a supplemental water supply for the city of Stockton. The intake location is on the southwestern tip of Empire Tract, adjacent to the Stockton DWSC. The maximum diversion rate for the initial phase of the project is 46 cfs (33,600 af/yr), which would increase to 248 cfs (125,900 af/yr) under the final (2050) phase of development. This project fulfills the treated water supply needs of full buildout under the City of Stockton’s 1990 General Plan. A final program EIR, with the City of Stockton as lead agency, was completed and submitted to the State Clearinghouse in October 2005. The Delta Water Supply project has been constructed and is operational.

As identified in the DEIR, the Delta Water Supply project would have significant effects on visual resources and air quality, and would contribute to a loss of agricultural land and urban growth. The Delta Water Supply project would have less-than significant effects on land use, water quality, hazardous materials, groundwater, soils, wetlands, special-status species and sensitive habitats, noise, traffic, utilities, cultural resources, and fish. The Delta Water Supply project could contribute to cumulative effects on water supply, water quality, special-status species and sensitive habits, fish, and loss of agricultural land.

Clifton Court Forebay–Jones Pumping Plant Intertie

This project would construct an intertie between the CVP and the Clifton Court Forebay (CCF). It would require an increase in the capacity of the proposed CCF screened intake (see description of Banks Pumping Plant Operations, above). This project would provide increased operational flexibility by modifying intake operations to improve the water quality of exports, improve water supply reliability, and minimize effects on fish entrainment. This project was included in the CALFED ROD and therefore is analyzed in this cumulative effect assessment. This project will likely be necessary as part of the BDCP isolated conveyance facility, if that facility is constructed. It could contribute to cumulative effects on water supplies and fish.

Delta Cross Channel Reoperation and Through-Delta Facility

As part of the CALFED ROD, changes in the operation of the Delta Cross-Canal (DCC) and the potential for a through-Delta facility (TDF) are being evaluated. Studies are being conducted to determine how changing the operations of the DCC could benefit fish and water quality. This evaluation will help determine whether a screened through-Delta facility is needed to improve fisheries and avoid water quality disruptions. In conjunction with the DCC operations studies, feasibility studies are being conducted to determine the effectiveness of a TDF. The TDF would include a screened diversion on the Sacramento River of up to 4,000 cfs and conveyance of that water into the Delta. These projects will probably be replaced by the BDCP, if that project is constructed.

Both a DCC reoperation and a TDF would change the flow patterns and water quality in the Delta, affecting fisheries, ecosystems, and water supply reliability. Thus, these projects could have cumulative effects on water supply, water quality, fish, and terrestrial biological resources.

Delta-Mendota Canal–California Aqueduct Intertie

This project would construct an intertie between the CVP’s Delta-Mendota Canal and the California Aqueduct just south of the Banks and Jones Pumping Plants. It would allow Reclamation to pump to the full permitted capacity of 4,600 cfs at Jones, resulting in a shift in timing of pumping and therefore filling San Luis Reservoir sooner and potentially increasing the amount of water delivered south of the Delta by an average of 35,000 af/yr. An Initial Study/Mitigated Negative Declaration was adopted in 2004 by the San Luis and Delta Mendota Water Authority, and Reclamation prepared a DEIS in July 2009 and an FEIS in November 2009. Project construction was completed in 2012.

This project could contribute to cumulative effects on water supplies and associated resources. It could modify the timing and magnitude of upstream reservoir releases in wet years to accommodate this increased conveyance capacity. Additional information is available at: <http://www.usbr.gov/mp/intertie/>.

Dutch Slough Tidal Marsh Restoration Project

This project proposes to restore wetlands and upland habitat and provide public access to the 1,166-acre Dutch Slough, which is currently owned by DWR (California Department of Water Resources and California State Coastal Conservancy 2008). The project is located in the city of Oakley in eastern Contra Costa County. The DEIR for the Dutch Slough restoration project was issued by DWR on November 20, 2008. The FEIR was approved by DWR on March 17, 2010. Project construction began in 2013 and is ongoing.

In the DEIR, Alternative 1 was selected as the environmentally superior alternative, with significant effects on hydrology and geomorphology, water quality, geology and soils, terrestrial and wetland biological resources, aquatic biological resources, air quality, recreation, cultural resources, and hazards and hazardous materials. Less-than significant effects were identified for noise, aesthetics, agricultural resources, transportation, and public services and utilities. Terrestrial and wetland biological resources could be cumulatively affected by the project. This project could also result in cumulative beneficial effects on habitat for aquatic species and on recreation. Additional information is available at:
<http://water.ca.gov/floodsafe/fessro/environmental/dee/dutchslough/index.cfm>.

Franks Tract Project

DWR and Reclamation propose to implement the Franks Tract Project to improve water quality and fisheries conditions in the Delta. DWR and Reclamation are evaluating installing operable gates to control the flow of water at key locations (Three Mile Slough and/or West False River) to reduce seawater intrusion, and to positively influence movement of fish species of concern to areas that provide favorable habitat conditions. By protecting fish resources, this project also would improve operational reliability of the SWP and the CVP because curtailments in water exports (pumping restrictions) are likely to be less frequent. The overall purpose of the

Franks Tract Project is to modify hydrodynamic conditions to protect and improve water quality in the central and south Delta, protect and enhance conditions for fish species of concern in the western and central Delta, and achieve greater operational flexibility for pump operations in the south Delta. The project gates would be operated seasonally and during certain hours of the day, depending on fisheries and tidal conditions. Boat passage facilities would be included to allow for passing of watercraft when the gates are in operation.

DWR and Reclamation have conducted studies to evaluate the feasibility of modifying the hydrodynamic conditions near Franks Tract to improve Delta water quality and enhance the aquatic ecosystem. The results of these studies have indicated that modifying the hydrodynamic conditions near Franks Tract may substantially reduce salinity in the Delta and protect fishery resources, including the sharply declining populations of delta smelt.

Preparation of a joint EIS/EIR for the project is underway. However, the project schedule is subject to availability of State Bond funds.

This project could contribute to cumulative fish and tidal hydraulic effects by changing flows in the North Delta to improve migratory conditions.

Freeport Regional Water Project

The Freeport Regional Water Project (FRWP) is a regional water supply project being developed on the Sacramento River near the town of Freeport by the Sacramento County Water Agency (SCWA) and the East Bay Municipal Utility District (EBMUD), in close coordination with the City of Sacramento and Reclamation. The project is designed to help meet future drinking water needs in the central Sacramento County area and supplement water conservation and recycling programs in the East Bay to provide adequate water supply during future drought periods.

FRWP will provide up to 100 mgd of water for EBMUD to use during drought years and 85 mgd for SCWA to use in all years. The project would divert water from the Sacramento River and deliver it to a Sacramento County Treatment Facility and the Folsom South Canal. From the Folsom South Canal, water will be delivered to the Mokelumne Aqueducts. This project includes construction of fish screens and a pumping plant at the intake on the Sacramento River, a water treatment facility in Sacramento County, and pipeline facilities to transport the water from Freeport to the Mokelumne Aqueducts. The FRWP intake facility, pipeline to the Vineyard Surface Water Treatment Plant (SWTP), and the SWTP itself, have been completed and are operational. Therefore, only operational effects are considered in this cumulative effect assessment.

The FRWP EIR/EIS identified significant effects on recreation, vegetation and wetlands, wildlife, noise, visual resources, and cultural resources. Less-than-significant effects were identified for water quality, water supply, fish, land use, agricultural resources, and public health. These effects would occur primarily at the FRWP facilities located at the intake, the pipelines, and on the Mokelumne River. Additional information can be found at: <http://www.freeportproject.org/index.php>.

Ironhouse Sanitary District Wastewater Treatment Plant Expansion

The Ironhouse Sanitary District (ISD) provides sewage collection, treatment, and disposal service to the city of Oakley, the unincorporated Bethel Island, and unincorporated areas in eastern Contra Costa County. In 1991, ISD proposed to upgrade and expand its wastewater treatment and disposal facilities. In 1994, ISD prepared, circulated, and certified a FEIR (State Clearinghouse Number 92093042) that described the potential effects on environmental resources for the proposed expansion. (ICF 2006)

Since the 1994 FEIR was certified, ISD expanded its treatment capacity from 2.3 mgd to 2.7 mgd, and also developed 396 acres of agricultural land on Jersey Island for irrigation with reclaimed water (treated effluent). In 2006, ISD prepared the *Draft Supplemental Environmental Impact Report for Ironhouse Sanitary District Wastewater Treatment Plant Expansion* to evaluate and disclose potential impacts of their proposed wastewater treatment expansion that were not considered in their 1994 EIR. The Final Supplemental EIR was prepared in January 2007. In that document, ISD selected the alternative that included a new 8.6 mgd treatment plant on ISD land adjacent to the existing plant (the first phase of the new plant would have a capacity of 4.3 mgd); 114 million gallons of existing storage capacity for treated effluent; a maximum of 510 acres of year-round irrigation lands for disposal of treated effluent; and a new discharge to the San Joaquin River, which would be located off the northern shore of Jersey Island (Contra Costa Local Agency Formation Commission 2007). The project has been completed and is operational.

As identified in the ISD DEIR, the ISD wastewater treatment plant would result in less-than significant impacts on agricultural resources (loss of farmland), air quality, cultural resources, hydrology and water quality, fish, vegetation and wildlife, geology, land use, noise, recreation, public services and utilities, public health/hazards, traffic and circulation, and visual resources. The ISD DEIR concluded that the ISD could contribute to cumulative impacts on fish, water quality, and loss of agricultural lands.

Level 2 Federal Refuge Water Supply Program

The 1992 CVIPA mandated that a secure, reliable source of water be established for wildlife refuges in the Sacramento and San Joaquin Valleys. Since 1992, an average of approximately 400,000 af/yr of Level 2 water has been delivered to these refuges to meet this requirement (U.S. Fish and Wildlife Service 2010). This water derives primarily from CVP water. The Level 2 Federal Refuge Water Supply Program could contribute to cumulative effects on water supply, and beneficial cumulative effects on wildlife habitat and fish.

Liberty Island Conservation Bank

Reclamation District 2093 (RD 2093) is acting as the lead agency for the Liberty Island Conservation Bank project located at the intersection of Liberty Cut and Liberty Slough on the northern tip of Liberty Island approximately 5 miles west of Courtland and 10 miles north of the City of Rio Vista in the southern Yolo Bypass which is part of the Sacramento Delta, located in Yolo County, California. The purpose of the project is to restore habitat for Delta native fish species for use as mitigation for effects to Delta native fish habitat in the region. The project is the creation of a conservation bank which would preserve, create, restore, and enhance habitat for all native Delta fish species including Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, California Central Valley Steelhead, delta smelt, and Central Valley fall- and late fall-run Chinook salmon.

The project consists of creating tidal channels, perennial marsh, and occasionally flooded uplands on the site. The project also includes the breaching of the northernmost east-west levee, and preservation and restoration of shaded riverine aquatic habitat along the levee shorelines of the tidal sloughs. The site provides a mosaic of interior tidal channels (i.e., open water) to connect interior island marshes to adjacent tidal channels. Construction of the project has been completed. Other restoration projects are also planned on Liberty Island.

Resources for which effects may be cumulatively considerable include agricultural and land use resources, air quality, biological resources (fish and Swainson’s hawk foraging habitat), and hydrology and water quality.

Los Vaqueros Reservoir Expansion

Reclamation, DWR, and CCWD are conducting a feasibility study examining alternatives to improve water quality and water supply reliability for Bay Area water users while enhancing the Delta environment through providing water for environmental uses, which will include expanding Los Vaqueros Reservoir as well as a variety of other alternatives. Current work has focused on planning-level evaluations of expanding Los Vaqueros Reservoir from 100,000 acre-feet up to 275,000 acre-feet in order to improve Bay Area water quality and water supply reliability, as well as provide water for environmental purposes. An expanded reservoir could require a new or expanded Delta intake. Locations being considered for the new Delta intake include Old River and adjacent channels. Water from an expanded reservoir could be delivered to Bay Area water users through a connection to the South Bay Aqueduct.

A draft planning report, including an evaluation of the environmental impacts of an expanded Los Vaqueros Reservoir on the Delta, was released in May 2003 (U.S. Bureau of Reclamation, Contra Costa Water District, and Western Area Power Administration 2010). Studies conducted for the draft planning report show that there would be no significant effect on water levels for current Delta water users, or on river velocities. An expanded Los Vaqueros could change the timing of diversions from the Delta. Passage of Measure N in March 2004 allowed further environmental and engineering studies to continue, with environmental review public scoping meetings held in 2006. The DEIR/DEIS was released in February 2009.

The FEIS/FEIR for this project was certified by CCWD on March 31, 2010, with Alternative 4 identified as the environmentally superior alternative under CEQA and as Reclamation's preferred alternative (Reclamation will identify their environmentally preferable alternative in the ROD). This alternative would increase storage capacity from 100 taf to 160 taf and does not include a new Delta intake and pump station. Construction of the project was completed in 2012.

The Los Vaqueros Reservoir Expansion could contribute to cumulative effects on water supplies and associated resources and could increase water supplies available for export in those years when Los Vaqueros Reservoir otherwise would have spilled. It also could modify the timing and magnitude of upstream reservoir releases in wet years and would reduce Delta outflow during diversions needed to fill the reservoir.

Lower San Joaquin Flood Improvements

The primary objective of the Lower San Joaquin Flood Improvements project is to "design and construct floodway improvements on the lower San Joaquin River and provide conveyance, flood control, and ecosystem benefits" (CALFED ROD). This potential project would construct setback levees in the South Delta Ecological Unit along the San Joaquin River between Mossdale and Stockton, and convert adjacent lands to overflow basins and nontidal wetlands or land designated for agricultural use. The levees are necessary for future urbanization and will be compatible with the Sacramento and San Joaquin River Basins comprehensive study.

If implemented, the potential project also may include the restoration of riparian and riverine aquatic habitat, increased riparian habitat, restrictions on dredging and sediment disposal, reduction of invasive plants, and protection and mitigation of effects on Threatened or Endangered species. Progress has been delayed indefinitely with no scheduled date for completion.

This potential project could contribute to ecosystem improvements in the lower San Joaquin River.

Monterey Plus (Monterey Amendment to the State Water Project Contracts)

In 1994, DWR and six water agencies (Kern County Agency, Tulare Lake Basin Water Storage District, Coachella Valley Water District, Metropolitan, Central Coast Water Authority, and Solano County Water Agency) established a set of principles, known as the *Monterey Agreement*, to settle long-term water allocation disputes and create a new management structure for the SWP. The Final EIR for the Monterey Agreement was completed in October 1995 and certified in November 1995. Subsequently, this EIR was challenged in a lawsuit, and on September 15, 2000, the California Third District Court of Appeals ruled the EIR failed to analyze certain impacts relating to water reallocation among contractors in the event of a permanent water shortage, and ordered a new EIR to be prepared. (California Department of Water Resources 2007)

As a result of the court's ruling, a new DEIR and FEIR, for a project retitled as the *Monterey Amendment*, were prepared, and the FEIR was certified on February 10, 2010. According the DEIR, the primary elements of the Monterey Amendment comprise the following:

- Altered water allocation procedures
- Permanent Table A water transfers and retirements
- New water supply management practices (California Department of Water Resources 2007).

In March of 2014, the California Superior Court ruled that the EIR failed to adequately assess the environmental effects of the operation of the Kern Water Bank, particularly on groundwater and water quality. Significant impacts were identified in the draft Monterey Plus EIR for terrestrial biological resources; visual resources; air quality; geology, soils, and mineral resources; recreation; and cultural resources. Less-than significant impacts were identified for surface water hydrology, water quality, and water supply; groundwater; agricultural resources; geology, soils, and mineral resources; land use and planning; hazards and hazardous materials; noise; public services and utilities; traffic and transportation; and energy. The Monterey Plus project could contribute to cumulative impacts on water supply; water quality; and fish species, including special-status species.

Mountain House Community

Trimark Communities has started development of a new community in the western portion of San Joaquin County along the Alameda–San Joaquin County line north of Interstate 205. At full buildout, 16,105 residential units on 4,784 acres would be developed. Mountain House is located directly south of Old River and west of Patterson Pass Road and will include residential, commercial, and some industrial development. It has been designed to accommodate all the needs of the expected 43,522 residents, including housing, jobs, retail, commercial, open space, and public services, such as schools, emergency services, and roads. The EIR was completed in 1994. Construction began in 2003. This project would contribute to cumulative urbanization and associated effects on water supply, water quality, and fish. It would also cumulatively contribute to loss of agricultural land.

National Marine Fisheries Service Biological Opinion Reasonable and Prudent Alternative for Central Valley Project/State Water Project OCAP

NMFS determined (June 2009) that for the OCAP, an RPA is necessary for the protection of salmon, steelhead, and green sturgeon. The RPA includes measures to improve habitat, reduce entrainment, and improve salvage, through both operational and physical changes in the system. Additionally, the RPA includes development of new monitoring and reporting groups to assist in water operations throughout the CVP and SWP systems and a requirement to study passage and other migratory conditions. The more substantial actions of the RPA include:

- providing fish passage at Shasta, Nimbus, and Folsom Dams;

- providing adequate rearing habitat on the lower Sacramento River and Yolo Bypass through alteration of operations, weirs, and restoration projects;

- establishing new San Joaquin River flows in April and May with reduced exports in April and May to protect San Joaquin River steelhead and Chinook salmon;

- reducing reverse OMR flows from January to June to protect Chinook salmon, steelhead, and green sturgeon;

- engineering projects to further reduce hydrologic effects and indirect loss of juveniles in the interior Delta; and

- technological modifications to improve temperature management in Folsom Reservoir.

Overall, the RPA is intended to avoid jeopardizing listed species or adversely modifying their critical habitat, but not necessarily to achieve recovery. Nonetheless, the RPA would result in benefits to salmon, steelhead, green sturgeon, and other fish and species that use the same habitats. Additional information is provided at: <http://deltacouncil.ca.gov/science-program/long-term-operations-opinions-annual-review-formerly-operations-criteria-and-plan-oc>.

North Bay Aqueduct Alternative Intake Project

The North Bay Aqueduct Alternative Intake Project would construct a new intake for the North Bay Aqueduct to increase the flow in the aqueduct. It will involve the construction of pipeline corridors and connection points to the existing North Bay Aqueduct. This project would construct and operate an alternative intake on the Sacramento River and connect it to the existing North Bay Aqueduct system by a new pipe segment. Proposed project facilities would be located in generally rural areas in Solano and Yolo Counties, west of the Sacramento River and north of Barker Slough. The new intake would be operated in conjunction with the existing North Bay Aqueduct located at Barker Slough. The proposed alternative intake and pumping station would be designed to accommodate the projected peak flow needs of up to 240 cfs. (California Department of Water Resources 2009.)

The notice of preparation for the EIR for the alternative intake project was issued by DWR (lead agency) on November 24, 2009. The public comment period ended on January 8, 2010. The project could contribute to cumulative effects on water supplies and associated resources. It could modify the timing and magnitude of upstream reservoir releases in wet years to accommodate this increased conveyance capacity. It could also contribute to considerable cumulative effects on water quality, fish, and loss of agricultural land. Additional information is available at: <http://www.water.ca.gov/engineering/Projects/Current/NBA/>.

North Delta Flood Control and Ecosystem Restoration Project

The purpose of the North Delta Flood Control and Ecosystem Restoration Project is to implement flood control improvements in the northeast Delta in a manner that benefits aquatic and terrestrial habitats, species, and ecological processes. The North Delta project area includes the North and South Fork Mokelumne Rivers and adjacent channels downstream of Interstate 5 and upstream of the San Joaquin River. Components being considered for flood control include bridge replacement, setback levees, dredging, island bypass systems, and island detention systems. The project will involve ecosystem restoration and science actions in this area, and improving and enhancing recreation opportunities. Many of the elements of this project are currently being considered in the BDCP planning and design process.

In support of the environmental review process, an NOP/NOI was prepared and public scoping was held in 2003.An EIR was prepared and certified in 2010, but the project is not currently funded for implementation. The EIR identified significant impacts on flood control, water quality, groundwater, geology and soils, air quality, noise, vegetation and wetlands, fish, wildlife, land use, public health, and cultural resources. Less-than significant impacts were identified on the following resources: geomorphology, water supply, transportation, population and housing, utilities, energy, and visual resources. If constructed, this project could contribute to cumulative impacts on geology and soils, loss of agricultural land, and cultural resources.

North-of-Delta Off-Stream Storage (Sites Reservoir)

Reclamation and DWR are studying several off-stream storage locations, including Sites Reservoir, located 70 miles northwest of Sacramento, as possible options for additional storage north of the Delta. With a potential maximum capacity of 1.8 maf, Sites Reservoir could increase the reliability of water supplies for a large portion of the Sacramento Valley and could improve fish migration by reducing water diversions on the Sacramento River.

Sites reservoir, as an off-stream project, would be filled primarily by pumped diversions from the Sacramento River. Water would be diverted into the reservoir during peak flow periods in winter months. To minimize potential effects of existing diversions on Sacramento River fisheries, Sites would release water back into the valley conveyance systems (such as the Glenn Colusa Irrigation District Canal and Tehama Colusa Canal) in exchange for water that would otherwise have been diverted from the Sacramento River. This undiverted summer water could become available for other downstream uses in the Bay-Delta.

A new Sites Reservoir could contribute to cumulative effects on water supplies and associated resources. It could increase water supplies available for export in those years when water otherwise would have been unavailable for storage and export, and modify the timing and magnitude of upstream reservoir releases in wet years.

An NOP/NOI for this project was issued in November 2001, and public scoping for the environmental document took place in January 2002. The initial alternatives information report was issued in May 2006 and a plan formulation report was issued in May 2009. In 2011, the Sites Joint Powers Authority (JPA) was formed to help plan and manage a future reservoir. Also in 2011, the State Water Resources Control Board (SWRCB) approved $1.75 million from Proposition 204 funds for the Sites JPA to continue working on environmental documentation. In March of 2014, a bill was introduced (H.R. 4300) to authorize Federal funding for a final feasibility study and to authorize construction (if the project is found to be feasible); the bill is under consideration by the House of Representatives Subcommitte on Water and Power.

Old River and Rock Slough Water Quality Improvement Project

CCWD completed the Old River and Rock Slough Water Quality Improvement Project in 2006. This project was designed to minimize salinity and other constituents of concern in drinking water by relocating or reducing agricultural drainage in the south Delta. CCWD intake facilities are located on Rock Slough and Old River, which also receive agricultural drainage water discharged from adjacent agricultural lands. Agricultural drainage water can adversely affect water quality entering the CCWD system.

Drainage from Veale Tract, which used to discharge directly into Rock Slough, is now discharged outside of Rock Slough in an area where strong currents quickly dilute the drainage without re-directing effects. The Old River project modified an agricultural drain discharge from Byron Tract by lengthening the outfall 150 feet further out into Old River. Previously, the outfall extended only to the immediate bank of the river where channel velocities are slow and dilution of the discharge was minimal. This project could have a cumulative effect on fish, including special-status species.

Red Bluff Diversion Dam Fish Passage Improvement Project

The Fish Passage Improvement Project includes construction of a pumping plant near the existing Tehama-Colusa headworks with an initial installed capacity of 2,180 cfs, with capability of adding pumps that will allow expansion to 2,500 cfs. Tehama-Colusa Canal Authority (TCCA) certified the EIR on June 4, 2008, and Reclamation signed the ROD on July 16, 2008. Construction of the pumping plant and fish screen were completed and became operational in 2012. The changed operations of the Red Bluff Diversion Dam (RBDD) will improve upstream fish passage. The new pumping plant will allow the RBDD gates to remain out (open) for approximately 10 months of the year. The pumping plant upstream from the dam will augment existing capabilities for diverting water into the Tehama-Colusa Canal during times when gravity diversion is not possible because the RBDD gates are out.

The new pumping plant would be capable of operating throughout the year, providing additional flexibility in dam gate operation and water diversions for the TCCA customers. In order to improve adult green sturgeon passage during their spawning migrations (generally March through July) the gates could remain open during the early part of the irrigation season and the new pumping plant could be used alone or in concert with other means to divert water to the Tehama-Colusa and Corning Canals.

Green sturgeon spawn upstream of the diversion dam, and the majority of adult upstream and downstream migrations occur prior to July and after August. After the new pumping plant has been constructed and is operational, Reclamation proposes to operate the RBDD with the gates in during the period from 4 days prior to the Memorial Day weekend to 3 days after the holiday weekend (to facilitate the Memorial Day boat races in Lake Red Bluff), and between July 1 and the end of the Labor Day weekend. This operation would provide improved sturgeon and salmon passage.

This project could contribute beneficially to a cumulative effect on fish. Additional information is provided at:. <http://www.usbr.gov/mp/2010_accomp_rpt/accomp/red_bluff/> and <http://www.usbr.gov/mp/rbfish/>.

River Islands at Lathrop Development

The Cambay Group, Inc. is proposing to develop approximately 4,990 acres of agricultural land and open space known as the River Islands at Lathrop Project. The project applicant intends to build a mixed-use residential/commercial development on Stewart Tract and Paradise Cut. Stewart Tract is an inbound island bounded by Paradise Cut, the San Joaquin River, and Old River. Paradise Cut is a flood control bypass connecting the San Joaquin River and Old River in the Delta. This mixed-use development is expected to include a town center, employment center, dock facilities, residences, and golf courses. It is expected to generate 31,680 residents and 16,751 jobs at full buildout. The Draft Subsequent EIR was completed in October 2002, and buildout of the development is planned for 2025. It could contribute to cumulative impacts on visual resources and loss of agricultural land.

Sacramento Valley Water Management Settlement Agreement (Phase 8)

The State Water Board has held proceedings regarding the responsibility for meeting the flow-related water quality standards in the Delta established by the Delta WQCP (D-1641). The State Water Board hearings have focused on which users should provide this water, and Phase 8 focuses on the Sacramento Valley users. The Sacramento Valley Water Management Settlement Agreement (SVWMSA) is an alternative to the State Water Board’s Phase 8 proceedings. The SVWMSA, entered into by DWR, Reclamation, Sacramento water users, and export water users, provides for a variety of local water management projects that will increase water supplies cumulatively. An environmental document is being prepared for the program.

Sacramento River Deep Water Ship Channel Deepening Project

The Sacramento River Deep Water Ship Channel (SRDWSC) is a 43.4-mile-long channel that lies within Contra Costa, Solano, Sacramento, and Yolo Counties and serves the marine terminal facilities at the Port of West Sacramento. The 30-foot-deep SRDWSC joins the 35-foot-deep John F. Baldwin Ship Channel at New York Slough, thereby affording access from Sacramento to the Bay area harbors and the Pacific Ocean. The project involves resuming construction of the 35-foot-deep channel (as authorized in the Supplemental Appropriations Act of 1985 [Public Law 99-88] and under Section 202[a] of the Water Resources and Development Act of 1986 [Public Law 99–662, 100 Stat. 4092]), to realize a transportation cost savings. USACE initiated construction to deepen the channel to -35 feet mean lower low water (MLLW) in 1989, completing dredging from river miles (RMs) 35.0 to 43.4. The deepening work was suspended in 1990 at the request of the Port of Sacramento due to funding constraints and issues pertaining to utility relocations. In 1998, Congress directed USACE to prepare a Limited Reevaluation Report for the remaining portions of the deepening project. A Draft Supplemental EIS/EIR was prepared in February 2011.

This project could contribute to cumulative effects on water quality.

San Joaquin River Restoration Program

The SJRRP is a comprehensive long-term effort to restore flows to the San Joaquin River from Friant Dam to the confluence of Merced River and restore a self-sustaining Chinook salmon fishery in the river while reducing or avoiding adverse water supply impacts from restoration flows. The Program is a direct result of a Stipulation of Settlement (Settlement) reached in September 2006 after more than 18 years of litigation of the lawsuit challenging the renewal of a long-term water service contract between the United States and CVP Friant Division contractors. The Settling Parties include U.S. Departments of the Interior and Commerce, the Natural Resources Defense Council (NRDC), and the Friant Water Users Authority (FWUA). The Settlement received Federal court approval in October 2006. The San Joaquin River Restoration Settlement Act (Act), included in the Omnibus Public Land Management Act of 2009, was signed by the President on March 30, 2009, and became Public Law

111-11. The Act authorizes and directs the Secretary of the Interior to fully implement the Settlement. The Settlement is based on two goals: to restore and maintain fish populations in “good condition” in the mainstem of the San Joaquin River below Friant Dam to the confluence of the Merced River, including naturally reproducing and self-sustaining populations of salmon and other fish; and to reduce or avoid adverse water supply impacts on all of the Friant Division long-term contractors that may result from the Interim Flows and Restoration Flows provided for in the Settlement. The Final Programmatic EIS/EIR was released in July of 2012, and a ROD was signed in September 2012. The next phase of the program consists of a DEIR/DEIS for the Mendota Pool Bypass and Reach 2B Channel Improvements Project, which is anticipated in 2015. Additional information is available at: <http://www.restoresjr.net/>.

This program could contribute beneficially to cumulative fish effects.

San Luis Reservoir Low Point Improvement Project

Reclamation, along with the San Luis and Delta-Mendota Water Authority and SCVWD, are proposing to implement the San Luis Reservoir Low Point Improvement project. The project would use one or a combination of alternatives, including treatment options, bypasses, and other storage options, to reduce the risk of “low point” water levels. High temperatures and factors in San Luis Reservoir create conditions that foster algae growth. The water quality in areas of the algal blooms is not suitable for agricultural water users with drip irrigation systems in San Benito County or for municipal and industrial water users relying on existing water treatment facilities in Santa Clara County. Typically, low point conditions occur when water levels in San Luis Reservoir reach an elevation of 369 feet msl or approximately 300 taf when the water is approximately 35 feet above the top of the Lower Pacheco Intake. If water levels fall below 369 feet, the San Felipe Division’s use of CVP supplies could be limited by algae-related water quality effects. San Luis Reservoir is the only delivery route for the San Felipe Division’s CVP supplies authorized under their current CVP Water Service Contracts.
The alternatives being considered to avoid water quality problems SCVWD in and to increase the effective storage capacity of the reservoir include, but are not limited to:

- conjunctive use with administrative actions,
- lowering the San Felipe Division intake facilities, and
- expanding Pacheco Reservoir.

An NOP/NOI to prepare an EIS/EIR was published in August 2008, and a Project Plan Formulation Report was released in 2011. Environmental studies are ongoing. Implementation of this project would provide flexibility in operation of the San Luis Reservoir and improve reliability of water deliveries to CVP contractors.

This project could contribute to cumulative effects on water supply and water quality.

Shasta Dam and Reservoir Enlargement

The CALFED ROD includes enlargement of Shasta Reservoir as an option to increase storage north of the Delta. Alternatives to expand Shasta Reservoir by raising the height of the dam by 6.5 to 18.5 feet would inundate a segment of McCloud River, protected under the California Wild and Scenic Rivers Act, as well as portions of the Pit River and Upper Sacramento River. The alternatives include modifications to the dam and reservoir re-operations. This project is in the planning stages, with an initial alternatives information report issued in 2004. A Plan Formulation Report was issued in 2008, and a DEIS was released in 2013.

Shasta Enlargement could contribute to cumulative effects on water supplies and associated resources and could increase water supplies available for export in those years when Shasta Reservoir otherwise would have spilled. It also could modify the timing and magnitude of upstream reservoir releases in wet years.

South Bay Aqueduct Enlargement

The purpose of the South Bay Aqueduct (SBA) Enlargement Project is to increase the capacity of the SBA from 270 cfs to 430 cfs to meet Zone 7 Water Agency's future needs and provide operational flexibility to reduce SWP peak power consumption. The Project includes the addition of four 45-cfs pumps to the South Bay Pumping Plant, including expanding the plant structure, a new service bay, and a new switchyard; constructing a third (Stage 3) Brushy Creek Pipeline and surge tank parallel to the existing two barrels; constructing a 500-acre-foot reservoir (425 acre-feet of active storage) to be served by the Stage 3 Brushy Creek Pipeline; raising the height of the canal embankments, canal lining, and canal overcrossing structures and bridges along the Dyer, Livermore, and Alameda Canals and at the Patterson Reservoir; modifying check structures and siphons along the Dyer, Livermore, and Alameda Canals; and constructing new drainage overcrossing structures to eliminate drainage into the canals. Construction of the project has been completed and the project is operational.

The SBA Enlargement Project could contribute to cumulative effects on water supplies and associated resources. It could modify the timing and magnitude of upstream reservoir releases in wet years to accommodate this increased conveyance capacity.

South Bay Salt Pond Restoration Project

The South Bay Salt Pond Restoration Project is the largest tidal wetland restoration project on the West Coast. When complete, the project will restore 15,100 acres of industrial salt ponds in the south San Francisco Bay to a mosaic of tidal wetlands and other habitats.

The project is being implemented by DFW and USFWS, in collaboration with the Coastal Conservancy. The goals are to restore and enhance a mix of wetland habitats, to provide wildlife-oriented public access and recreation, and to provide for flood management in the South Bay. An FEIS/EIR was released in December 2007. Phase I of the project, including design and construction of habitat, and implementation of recreation and flood protection features at 16 of the pond complexes, began in 2008 and is ongoing. Phase II of the project is in the planning stages. Additional information is available at: <http://www.southbayrestoration.org/track-our-progress/>.

The project could cumulatively increase tidal wetlands in the bay area and reduce habitats for species dependent on the salt marshes.

South Delta Improvements Program

The SDIP is a series of proposed actions that improve water quality and protect salmon in the southern part of the Sacramento-San Joaquin Delta while allowing the State Water Project to operate more effectively to meet California's existing and future water needs. The SDIP is divided into Stages 1 and 2. Stage 1 includes the construction and operation of permanent operable gates (to replace the temporary barriers), dredging in portions of the south Delta, and extension of some agricultural diversion structures by 2012. The operation of the gates is included in the OCAP analysis. The head of Old River gate would be operated between April 15 and May 15 and in the fall. The remaining three agricultural gates would be operated April 15 through the agricultural season. The gates would maintain south Delta water levels above 0.0 msl for channels upstream of the operable gates. Stage 2 addresses the proposed operational component to increase water deliveries south of the Delta by increasing the permitting diversion amount at CCF to 8,500 cfs. All of SDIP was evaluated in an EIS/EIR, finalized in 2006. DWR and Reclamation are preparing a supplemental document for Stage 1. Neither agency intends to pursue Stage 2 in the near future, nor is it likely to occur in the near future due to POD, but it is included in the cumulative analysis because it is foreseeable if Delta conditions improve and DWR or Reclamation decides to pursue it.

The SDIP has the potential to affect nearly all the same resources as are affected by the Project applicant, and could be implemented during the 50-year life of the Proposed Project. Specifically, the SDIP would result in impacts related to geology and soils, air quality, fish, vegetation and wetlands, wildlife, visual resources, and cultural resources. Other less-than-significant changes in tidal hydraulics, water quality, recreation, levee stability, agricultural resources, public health and traffic would also occur. These impacts would occur primarily in the south Delta. Stage 1 would improve water supply for in-Delta diverters, while Stage 2 would improve water supply for south-of-Delta users. Additional information is provided at: <http://baydeltaoffice.water.ca.gov/sdb/sdip/index_sdip.cfm>.

State Water Project—Oroville Facilities

Lake Oroville and Oroville Dam are part of a complex which includes Hyatt Powerplant, Thermalito Diversion Dam and Powerplant, the Feather River Fish Hatchery, Thermalito Power Canal, Thermalito Forebay, Thermalito Pumping- Generating Plant, Thermalito Afterbay, and the Lake Oroville Visitors Center.

The SWP Oroville facility operations are regulated by the Federal Energy Regulatory Commission (FERC) and the State Water Board. A new license from FERC is being sought by DWR. Until FERC issues the new license for the Oroville Project, DWR will not significantly change the operations of the facilities and when the FERC license is issued, it is assumed that downstream of Thermalito Afterbay Outlet, the future flows will remain the same. There is a great deal of uncertainty as to when the license will be issued and what conditions will be imposed by FERC and the State Water Board.

The process that DWR must follow to obtain the new license is as follows.

DWR finalized the Final EIR in July 2008; the SWRCB authorized the CWA Section 401 Certification for the project in 2010. A Biological Opinion (BO) is in the process of being prepared by NMFS. Once that step is completed, it is anticipated that FERC will issue the new license. When the new FERC license is issued, additional flow or temperature requirements may be required. At this time, DWR assumes that the flow and temperature conditions required will be those in the FERC Settlement Agreement (SA); therefore, those are what DWR proposes for the near-term and future Oroville operations.

The proposed future operations in the SA include 100–200 cfs increase in flows in the low-flow channel of the Lower Feather River and reduced water temperatures at the Feather River Hatchery and in the low-flow channel. It is unlikely that either the proposed minor flow changes in the low-flow channel or the reduced water temperatures will affect conditions in the Sacramento River downstream of the confluence, but if they were detectable, they would be beneficial to anadromous fish in the Sacramento River.

The SA includes habitat restoration actions such as side-channel construction, structural habitat improvement such as boulders and large woody debris, spawning gravel augmentation, a fish counting weir, riparian vegetation and floodplain restoration, and facility modifications to improve coldwater temperatures in the low and high flow channels. These actions are designed to improve conditions for Chinook salmon and steelhead in the Feather River.

As such, this project could contribute beneficially to cumulative fish effects. Additional information is provided at: <http://www.water.ca.gov/orovillerelicensing/>.

Stockton Deep Water Ship Channel Deepening Project

Phase I of the John F. Baldwin Ship Channel project resulted in the construction of the San Francisco Bar Channel in 1974. The project created the Pacific Ocean offshore approach channel to the San Francisco Bar Channel Entrance. This shipping channel (55 feet deep MLLW and 2000 feet wide) serves as the exclusive deep water ocean entrance to the San Francisco Bay. Completed in 1986, Phase II of the project deepened the central San Francisco Bay channel to -45 feet MLLW. Phase IV consisted of deepening the Stockton Deep Water Channel to -35 feet MLLW in 1988. Based on a 1965 Congressional authorization, Phase III of the project called for deepening from -35 feet to -45 feet MLLW. However, a 1997 recommendation entailed purusing a pipeline as a substitute for channel deepening. The pipeline was never built. In 1988, congress directed that investigations begin to determine the feasibility of deepening the Stockton Deep Water Chip Channel to -40 feet MLLW. A General Reevaluation Report was prepared by USACE in 2012.

This project could contribute to cumulative effects on water quality.

Suisun Marsh Management Plan

Reclamation, USFWS, and DFW are NEPA and CEQA lead agencies in the development of a management plan to restore 5,000 to 7,000 acres of tidal wetlands and enhance existing seasonal wetlands in Suisun Marsh. The plan would be implemented over 30 years and is expected to contribute to the recovery of many terrestrial and aquatic species. The plan's objectives include improving habitat for multiple special-status species, maintaining the heritage of waterfowl hunting and other recreational opportunities, improving water quality to assist fish migration and spawning, and improving and maintaining the levee system to protect property, infrastructure, and wildlife habitats from flooding. The Final EIS/EIR for the plan was released in December 2011, and the Record of Decision for the Suisun Marsh Management Plan was signed in 2014. Plan implementation could contribute to cumulative recreation, fish, levee stability, and terrestrial species effects.

SWP Harvey O. Banks Pumping Plant Operations

Banks Pumping Plant has a physical export pumping capacity of 10,300 cfs; however, current permit terms limit the diversion of water to CCF to 6,680 cfs. Implementation of the SDIP, as described above, would have increased allowable diversions at CCF from 6,680 cfs to 8,500 cfs. Although Banks Pumping at 10,300 cfs was included in the CALFED ROD, given the POD and other major challenges that are occurring with the currently permitted amount, it is unlikely that this capacity will ever be attained. Additional future changes in the CCF or the Skinner Fish facility or the Banks Pumping Plant are being considered by DWR within the overall BDCP planning and design process.

Upper San Joaquin River Basin Storage

The Upper San Joaquin River Basin Storage Investigation is a feasibility study by Reclamation and DWR. The purpose of the investigation is to determine the type and extent of Federal, state and regional interests in a potential project in the upper San Joaquin River watershed to expand water storage capacity; improve water supply reliability and flexibility of the water management system for agricultural, urban, and environmental uses; and enhance San Joaquin River water temperature and flow conditions to support anadromous fish restoration efforts.

DWR, Reclamation, and their partners have developed a two-phase Plan of Study. Phase 1 will identify water resource opportunities and issues in the Upper San Joaquin River watershed. This phase will include an appraisal of opportunities to increase surface storage and conjunctive uses for groundwater. Phase 2 will be more detailed and will begin with public meetings to determine the scope of the study.

Several reports, including alternatives analyses, feasibility studies, and engineering studies, have been released since 2003 and are ongoing. A DEIR/DEIS is anticipated for public release in 2015.

This project could contribute to cumulative effects related to water supplies and associated resources including fish and terrestrial species. Additional information is available at: <http://www.usbr.gov/mp/sccao/storage/>.

U.S. Fish and Wildlife Service Biological Opinion Reasonable and Prudent Alternative for Central Valley Project /State Water Project OCAP

The USFWS determined (December 2008) that for the CVP-SWP Operations and Criteria Plan (OCAP), an RPA is necessary for the protection of delta smelt. The RPA includes measures to: (1) prevent/reduce entrainment of delta smelt at Jones and Banks Pumping Plants; (2) provide adequate habitat conditions that will allow the adult delta smelt to successfully migrate and spawn in the Bay-Delta; (3) provide adequate habitat conditions that will allow larvae and juvenile delta smelt to rear in the Bay-Delta; (4) provide suitable habitat conditions that will allow successful recruitment of juvenile delta smelt to adulthood; and (5) monitor delta smelt abundance and distribution through continued sampling programs through the IEP. The RPA comprises the following actions:

- **Action 1:** To protect pre-spawning adults, exports would be limited starting as early as December 1 (depending on monitoring triggers) so that the average daily OMR flow is no more negative than -2,000 cfs for a total duration of 14 days.

- **Action 2:** To further protect pre-spawning adults, the range of net daily OMR flows will be no more negative than -1,250 to -5,000 cfs (as recommended by smelt working group) beginning immediately after Action 1 as needed.

- **Action 3:** To protect larvae and small juveniles, the net daily OMR flow will be no more negative than -1,250 to -5,000 cfs (as recommended by the smelt working group) for a period that depends on monitoring triggers (generally March through June 30).

- **Action 4:** To protect fall habitat conditions, sufficient Delta outflow will be provided to maintain average X2 for September and October no greater (more eastward) than 74 km (Chipps Island) in the fall following wet years and 81 km (Collinsville) in the fall following above-normal years.

- **Action 5:** The head of Old River barrier will not be installed if delta smelt entrainment is a concern. If installation of the head of Old River barrier is not allowed, the agricultural barriers would be installed as described in the project description.

- **Action 6:** A program to create or restore a minimum of 8,000 acres of intertidal and associated subtidal habitat in the Delta and Suisun Marsh will be implemented within 10 years. A monitoring program will be developed to focus on the effectiveness of the restoration program.

These actions are intended to ensure that operations of the CVP and SWP do not lead to jeopardy of this species. Since delta smelt spend their entire life-cycle in the Delta, these actions are expected to significantly improve conditions for this population compared to previous operational scenarios. This RPA would contribute beneficially to a cumulative effect on delta smelt.

Additional information on this RPA and the associated BO is provided at: <http://www.fws.gov/sfbaydelta/cvp-swp/cvp-swp.cfm>.

Projects in Contra Costa General Plan

The *Contra Costa General Plan 2005–2020* (2005) states that East Contra Costa County (unincorporated Bethel Island, Discovery Bay, Brentwood, Oakley) is projected to add 29,600 homes, which would result in approximately 97,800 more people by 2020 (Contra Costa County 2005). Bethel Island; the land north, south, and east of Discovery Bay; and the land between Discovery Bay and Brentwood/Oakley are considered important agricultural areas. This development would contribute to cumulative urbanization and associated impacts on water supply, water quality, and fish. This development would also cumulatively contribute to loss of agricultural land.

Projects in San Joaquin County General Plan

The *San Joaquin County General Plan* is currently being updated; the update process began in June 2008 and is ongoing. The most recent version of the complete general plan is from 1992, but information from this version was not used for this cumulative analysis due to the likelihood of it being out of date (i.e., 21 years old).

However, a revised Housing Element for San Joaquin County was adopted by the county board of supervisors on January 12, 2010. According to this document, planned development in the vicinities of Stockton and Tracy would convert agricultural lands to residential uses. This development would contribute to cumulative urbanization and associated impacts on water supply, water quality, and fish. It would also cumulatively contribute to loss of agricultural land.

ANALYSIS OF CUMULATIVE EFFECTS

The cumulative effects that are anticipated to result from implementation of the Delta Wetlands project, together with the cumulative projects described above, are evaluated in this SDEIS within each of the 19 environmental issue areas (i.e., Sections 3.1 through 3.19) of Chapter 3. The CEQ (1997) provides that the discussion of cumulative effects should reflect the severity of the effects and their likelihood of occurrence, but the discussion need not provide as great a detail as is provided of the effects attributable to the project alone. Cumulative effects discussions are provided after the analysis of project-specific effects for each resource section.

The cumulative effects of implementing the Proposed Action (Alternative 2) or either of the other action alternatives (Alternatives 1 and 3) would be substantially similar; therefore, this cumulative analysis uses the term "project" to refer to all of the action alternatives. There would be no project-related cumulative effects from adoption of the No-Action Alternative, because the project would not be implemented and the existing agricultural uses on the four project islands would continue.

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3.1 AESTHETICS

3.1.1 INTRODUCTION

This section describes recent changes to the existing environmental conditions and regulatory framework of the project study area, summarizes the unchanged affected environment, and describes changed environmental effects related to aesthetics of the project. A review and update of the 1995 DEIR/EIS aesthetics assessment was incorporated in the 2001 FEIS. Chapter 3J in the 2001 FEIS provided detailed information regarding aesthetics associated with the project and in the Sacramento-San Joaquin Delta (Delta) in general. The aesthetics effects of the project were analyzed most recently in Section 4.9 and Chapter 5 of the 2010 DEIR, which also served as a basis for this analysis. The 1995 DEIR/EIS, 2001 FEIS, and 2010 DEIR are herein incorporated by reference.

The 2001 FEIS concluded that the project would adversely affect aesthetics in the vicinity of the four project islands. Since that time, there have been no changes in the project that result in new significant adverse environmental effects or a substantial increase in the severity of previously identified significant effects on aesthetics.

The project would not have any direct effects on aesthetics in the places of use; the effects on aesthetics, if any, associated with the provision of project water to the places of use are addressed in the "Secondary and Cumulative Effects" subsection below, and in Chapter 4, "Other Statutory Requirements."

Identification of the project's specific places of use does not affect aesthetics in any way that alters the conclusions of the 2001 FEIS. Any minor changes in the "Affected Environment" and "Regulatory Framework/ Applicable Laws, Regulations, Plans, and Policies" subsections since the 2001 FEIS do not alter the prior document's conclusions, and such changes are addressed by the urban water management plan EIR of each affected place of use.

SUMMARY OF CHANGES, NEW CIRCUMSTANCES, AND NEW INFORMATION

Substantial Changes in the Project

Since the 2001 FEIS was completed, there have been no substantial changes in the project resulting in new significant effects or substantial increase in the severity of effects on aesthetics. However, the project no longer includes a proposal to construct new recreation facilities on the Reservoir or Habitat Islands; this change to the project results in a reduction and/or elimination of some the previously identified environmental effects.

New Circumstances

Since the 2001 FEIS, there have been no new circumstances that result in new significant effects or substantial increase in the severity of effects on aesthetics.

New Information

There is no new information that would result in new significant effects or a substantial increase in severity of effects on aesthetics.

SUMMARY OF ENVIRONMENTAL COMMITMENTS

Environmental commitments are measures incorporated by the project applicant as part of the project, meaning they are proposed as elements of the Proposed Action and are therefore considered in conducting the environmental analysis for each resource area of this SEIS. The purpose of environmental commitments is to reflect and incorporate best practices into the project that avoid, minimize, reduce, or offset potential adverse environmental effects. A complete description of the environmental commitments that have been incorporated into the project since the 2001 FEIS is contained in Chapter 2, "Project Description and Alternatives" of this SEIS. There are no environmental commitments that would affect the analysis or effect conclusions related to aesthetics.

3.1.2 AFFECTED ENVIRONMENT

CONCEPTS AND TERMINOLOGY

Identifying the project's aesthetics and conditions involves three steps:

- objective identification of the visual features (visual resources) of the landscape;
- assessment of the character and quality of those resources relative to overall regional visual character; and
- determination of the importance to people, or sensitivity, of views of aesthetics in the landscape.

The aesthetic value of an area is a measure of its visual character and quality, combined with the viewer response to the area (Federal Highway Administration 1988). Scenic quality can best be described as the overall impression that an individual viewer retains after driving through, walking through, or flying over an area (U.S. Bureau of Land Management 1980). Viewer response is a combination of viewer exposure and viewer sensitivity. Viewer exposure is a function of the number of viewers, number of views seen, distance of the viewers, and viewing duration. Viewer sensitivity relates to the extent of the public's concern for a particular viewshed. These terms and criteria are described in detail below.

Visual Character

Natural and artificial landscape features contribute to the visual character of an area or view. Visual character is influenced by geologic, hydrologic, botanical, wildlife, recreational, and urban features. Urban features consist of those associated with landscape settlements and development, including roads, utilities, structures, earthworks, and the results of other human activities. The perception of visual character can vary substantially by season, even by hour, as weather, light, shadow, and elements that comprise the viewshed change. The basic components used to describe visual character for most visual assessments are the elements of form, line, color, and texture of the landscape features (U.S. Forest Service 1995; Federal Highway Administration 1988). The appearance of the landscape is described in terms of the dominance of each of these components.

Visual Quality

Visual quality is evaluated using the approach to visual analysis adopted by the Federal Highway Administration, employing the concepts of vividness, intactness, and unity (Federal Highway Administration 1988; Jones et al. 1975), which are described below.

- Vividness is the visual power or memorability of landscape components as they combine in striking and distinctive visual patterns.

- Intactness is the visual integrity of the natural and human-built landscape and its freedom from encroaching elements; this factor can be present in well-kept urban and rural landscapes, and in natural settings.

- Unity is the visual coherence and compositional harmony of the landscape considered as a whole; it frequently attests to the careful design of individual components in the landscape.

Visual quality is evaluated based on the relative degree of vividness, intactness, and unity, as modified by its visual sensitivity. High-quality views are highly vivid, relatively intact, and exhibit a high degree of visual unity. Low-quality views lack vividness, are not visually intact, and possess a low degree of visual unity.

Visual Exposure and Sensitivity

The measure of the quality of a view must be tempered by the overall sensitivity of the viewer. Viewer sensitivity or concern is based on the visibility of resources in the landscape, proximity of viewers to the visual resource, elevation of viewers relative to the visual resource, frequency and duration of views, number of viewers, and type and expectations of individuals and viewer groups.

The importance of a view is related in part to the position of the viewer to the resource; therefore, visibility and visual dominance of landscape elements depend on their placement within the viewshed. A viewshed is defined as all of the surface area visible from a particular location (e.g., an overlook) or sequence of locations (e.g., a roadway or trail) (Federal Highway Administration 1988). To identify the importance of views of a resource, a viewshed must be broken into distance zones of foreground, middleground, and background. Generally, the closer a resource is to the viewer, the more dominant it is and the greater its importance to the viewer. Although distance zones in a viewshed may vary between different geographic regions or types of terrain, the standard foreground zone is 0.25–0.5 mile from the viewer, the middleground zone is from the foreground zone to 3–5 miles from the viewer, and the background zone is from the middleground to infinity (U.S. Forest Service 1995).

Visual sensitivity depends on the number and type of viewers and the frequency and duration of views. Visual sensitivity also is modified by viewer activity, awareness, and visual expectations in relation to the number of viewers and viewing duration. For example, visual sensitivity is generally higher for views seen by people who are driving for pleasure; people engaging in recreational activities such as hiking, biking, or camping; and homeowners. Sensitivity tends to be lower for views seen by people driving to and from work or as part of their work (U.S. Forest Service 1995; Federal Highway Administration 1988; U.S. Soil Conservation Service 1978). Commuters and nonrecreational travelers have generally fleeting views and tend to focus on commute traffic, not on surrounding scenery; therefore, they generally are considered to have low visual sensitivity. Residential viewers typically have extended viewing periods and are concerned about changes in the views from their homes; therefore, they generally are considered to have high visual sensitivity. Viewers using recreation trails and areas, scenic highways, and scenic overlooks, usually are assessed as having high visual sensitivity.

Judgments of visual quality and viewer response must be made based in a regional frame of reference (U.S. Soil Conservation Service 1978). The same landform or visual resource appearing in different geographic areas could have a different degree of visual quality and sensitivity in each setting. For example, a small hill may be an important visual element on a flat landscape but have very little importance in mountainous terrain.

VISUAL RESOURCES IN THE DELTA REGION

The Delta is an extensive, largely agricultural region linking the Central Valley and the San Francisco Bay Area. Views in the Delta are dominated by flat, open agricultural land and sloughs and rivers that are bordered by levees. Scattered trees occasionally break the horizon, but typical views encompass agricultural fields.

The Delta waterways are important visual features because they contribute to the visual character of the region by enhancing the vividness of views in the Delta. Because few roads traverse the Delta islands, the unique Delta landscape is accessible primarily by boat.

The visual resources associated with the four project islands are typical of the region. Views of the project islands from levee roads have some variety in form, line, color, and texture but are not unique to the region. The sensitivity of the visual resources of the four islands varies from island to island based on the wide variability in access to and travel patterns on the islands. The character of the views changes with the season, time of day, and weather, but the quality of the views is relatively uniform.

Bacon Island

Bacon Island is accessible only on its eastern side by a local levee road (Bacon Island Road). Views from the road toward the Bacon Island interior are dominated by intensely farmed agricultural open space with scattered woody vegetation, farm buildings, and rural residences. Mt. Diablo can be seen to the west from Bacon Island Road, providing a background visual element that enhances the vividness of the viewshed from the road. Except for the utility lines that run along the perimeter of Bacon Island, the views of the island from the road are generally intact. The views are not vivid, however, and are common for the region. The overall visual quality of the island from Bacon Island Road is considered moderate.

Bacon Island Road is a locally designated scenic route (San Joaquin County 1992:VI-6) because of its recreational access and use characteristics and its visual relationship to the adjacent waterway. The road carries a low volume of traffic, and the remainder of the island is largely inaccessible to the public. The visual resources on this island as viewed from Bacon Island Road are considered moderately sensitive because of the small number of visitors traveling the road and the inaccessibility of the rest of the island interior.

Views of the Bacon Island levees from adjacent waterways consist of a variety of forms and colors created by changing elevations between the water level and the levee and by textural differences among the water, the marsh, and the riparian vegetation along the water side of the levees. The views from the waterways are vivid and relatively intact but are common to the region. The overall visual quality of the island viewsheds from the water is considered moderate.

A portion of Middle River along the east side of Bacon Island and a portion of Connection Slough bordering the island to the north are recreation areas and are frequently used by boaters and anglers. Views of the island perimeter levees from these waterways are considered highly sensitive because many recreationists use these waterways.

The Santa Fe Railways Amtrak line immediately south of Bacon Island runs passenger trains between Stockton and Richmond, California. Views of the Bacon Island southern exterior levee from the train are similar to views of the levee from the adjacent waterway along the south side of Bacon Island (Santa Fe Cut). Views of Bacon Island from the railway are considered highly sensitive.

Webb Tract

Interior views of Webb Tract are dominated by agriculture, but the intensity of agricultural production on this island is low compared with that of Bacon Island. Webb Tract has more natural vegetation and high visual variability because of the scattered woody vegetation and blowout ponds. Views of the island from the levee tops are vivid and intact because the visual resources vary and present a natural setting free from encroaching elements. The overall visual quality of resources on Webb Tract therefore is considered high.

Public access is more limited on Webb Tract than on any of the other project islands. No bridges provide access to the island; it is accessible only by ferry. The number of visitors to the island is low; thus, the visual sensitivity of the Webb Tract landscape as viewed from perimeter levees and other parts of the island interior is considered low.

Views of Webb Tract from adjacent waterways are similar to those described above for Bacon Island. The views are generally intact and vivid but are common to the region. The overall visual quality of the landscape from the waterways is moderate.

All of the waterways surrounding Webb Tract have been locally designated as scenic waterways (Contra Costa County 2005:9-4 through 9-6). The Webb Tract perimeter levees as viewed from these waterways therefore are considered a highly sensitive visual resource.

Bouldin Island

Public access to the interior of Bouldin Island is limited to travelers crossing the island on State Route (SR) 12. Views from SR 12 toward the interior of Bouldin Island are dominated by intensely farmed agricultural open space with scattered woody vegetation, farm buildings, and rural residential units. Utility lines cross the highway, detracting from the intactness of views of the island. The overall visual quality of Bouldin Island is considered moderate because the visual resources are somewhat intact but are not especially vivid, and because the views are common to the region.

Because Bouldin Island is visible to people and motorists from SR 12 and many of the viewers are recreationists in the Delta, visual sensitivity for part of the viewer group could be high. The duration of views for viewers along SR 12 is brief, however, because there are no vista points or rest areas on Bouldin Island from which to prolong the views. Therefore, the overall visual sensitivity is considered moderate for views of the island along SR 12. The views of Bouldin Island are not especially vivid and are common to the region, and SR 12 across the island is not considered eligible for designation as a scenic route. Therefore, the overall visual quality of Bouldin Island is considered moderate for views from SR 12.

Views of Bouldin Island from adjacent waterways are similar to those described above for Bacon Island. The overall visual quality of the landscape from the waterways is moderate; these views are generally intact and vivid but are common to the region. Potato Slough south of Bouldin Island is a recreation area, so the south perimeter levee commonly is viewed by boaters and anglers. The Bouldin Island east perimeter levee is visible from marina facilities across Little Potato Slough on Terminous Tract, both north and south of SR 12. Views of these perimeter levees from the waterways are considered highly sensitive because many recreationists use these waterways.

Holland Tract

Public access to Holland Tract is limited to Holland Tract Road along the south levee. Views of Holland Tract from the road consist of agricultural fields and some fallow areas with established woody vegetation along the levee and toward the center of the island. This vegetation adds somewhat to the variety and texture of views and generally enhances the vividness of views of the island. The overall visual quality of resources on Holland Tract is considered moderate because the views are generally common to the region.

One small bridge at the southwest corner of Holland Tract provides access across Rock Slough to the marinas located on the southern levee; other parts of Holland Tract are inaccessible to the public. Furthermore, Holland Tract Road has no scenic corridor designation. Visual sensitivity of the Holland Tract landscape from the road therefore is considered moderate.

Views of Holland Tract from adjacent waterways consist of developed marina facilities on the southern and eastern sides of the island and vegetated levees in other areas. The marina facilities that border Holland Tract for about 2/3 mile consist of covered and uncovered boat berths. Small ancillary buildings and covered berths are constructed partly of wood siding. Wood pilings in the water adjacent to one of the marinas are connected by a low, narrow ridge of automobile tires. Because these view components generally disrupt the intactness and unity of views in marina areas, visual quality is low along the water side of the levees in the marina areas.

Views of Holland Tract from adjacent waterways away from the marinas are similar to those described above for the other project islands. The views are generally intact and somewhat vivid but are common to the region; therefore, the overall visual quality of the landscape from the waterways is moderate.

Old River, which borders the eastern side of Holland Tract, and Roosevelt Cut and the flooded Franks Tract waters north of Holland Tract are locally designated as scenic waterways (Contra Costa County 2005:9-4 through 9-6). The view of Holland Tract levees from these waterways is considered highly sensitive because many boaters and anglers use these waterways.

3.1.3 Regulatory Framework/Applicable Laws, Regulations, Plans, and Policies

Federal applicable laws and regulations are provided because they are required under NEPA. State applicable laws and regulations are provided for informational purposes and to assist with NEPA review. USACE has considered applicable state, regional, and local plans and ordinances as a part of the environmental review process for this SEIS, where applicable.

Federal

There are no Federal laws, regulations, plans, or policies that would apply to the Proposed Action or alternatives under consideration.

State

California Department of Transportation

The California Department of Transportation (Caltrans) manages the California Scenic Highway Program. The goal of the program is to preserve and protect scenic highway corridors from changes that would affect the aesthetic value of the land adjacent to designated highways. However, there are no state-designated scenic highways in the project vicinity.

3.1.4 Assessment Methodology

The analysis of environmental effect on visual resources was prepared by considering the visual features that are present, assessing the character and quality of those resources relative to overall regional visual character; and determining the sensitivity of views. Change to the views of the project islands that would occur from project implementation were then considered in relationship to the above criteria.

Significance Criteria

The basis for determining the significance of effects for this analysis is based on professional standards, project-specific criteria developed by the lead agency to address potential effects unique to the project's location and elements, and is informed by the criteria contained in the Environmental Checklist in Appendix G of the State CEQA Guidelines. These thresholds encompass the factors taken into account under NEPA to determine the significance of an action in terms of its context and the intensity of its effects. The Proposed Action or alternatives under consideration would have a significant, adverse effect on aesthetics if they would do any of the following:

- cause a substantial, demonstrable negative aesthetic effect on a scenic vista or view open to the public;
- substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway;
- substantially degrade the existing visual character or quality of the site and its surroundings; or
- create a new source of substantial light or glare that would adversely affect day or nighttime public views.

The project would have a beneficial effect on aesthetics if it would improve the visual quality of views or if it would provide new viewing opportunities in the project study area.

3.1.5 ENVIRONMENTAL CONSEQUENCES AND MITIGATION MEASURES

EFFECTS ANALYSIS

Effects on aesthetics resulting from project implementation were described in the 2001 FEIS (Chapter 3J) and are listed below in Table 3.1-1. Where there have been no changes to the effects analysis or conclusions, the 2001 FEIS is incorporated by reference, and the effects conclusions and mitigation measures are briefly summarized.

No-Action Alternative

EFFECT VIS-1 **Reduction in the Quality of Views of Bacon Island and Webb Tract Interiors from Island Levees.** *Intensified agricultural uses would reduce the visual quality on the Reservoir Island interiors, but there are low numbers of sensitive viewers. This effect is less than significant.*

Implementation of the No-Action Alternative would generally result in the continuation of existing land uses; agricultural intensity on the islands would increase as areas that are currently fallow are converted to agricultural use. Views of the islands (both interior and exterior) would not substantially change under the No-Action Alternative. Increasing agricultural use on Bacon Island and Webb Tracts could reduce the vividness of interior island views, but because of the low number of viewers on Bacon Island and Webb Tracts, these changes are considered **less than significant.**

EFFECT VIS-2 **Potential Conflict with Local Scenic Designation for Bacon Island Road.** *No new facilities would be constructed in the viewshed of Bacon Island Road. No effect would occur.*

Because the proposed facilities would not be constructed under the No-Action Alternative, vegetation would not be removed along project levees and rock revetment would not be introduced, and a siphon station facility would not be placed in the viewshed of Bacon Island Road—a locally-designated scenic corridor. Therefore, no conflict with the local scenic designation for Bacon Island Road would occur, and there would be **no effect.**

EFFECT VIS-3 **Reduction in the Quality of Views of Bacon Island and Webb Tract from Adjacent Waterways and from the Santa Fe Railways Amtrak Line.** *The No-Action Alternative would not substantially change views of Reservoir Island levees from adjacent waterways or from the Santa Fe Railways Amtrak Line. This effect is less than significant.*

Implementation of the No-Action Alternative would generally result in the continuation of existing land uses; agricultural intensity on the islands would increase as areas that are currently fallow are converted to agricultural use. Views of the islands (both interior and exterior) would not substantially change under the No-Action Alternative. Increasing agricultural use on Bacon Island and Webb Tracts could reduce the vividness of interior island views, but the increased agricultural uses would be consistent with existing uses. Therefore, this effect is **less than significant**.

EFFECT VIS-4 **Change in Bouldin Island Views from State Route 12.** *The No-Action Alternative would not change views of Bouldin Island from SR 12. No effect would occur.*

Because the proposed facilities would not be constructed under the No-Action Alternative, there would be no change in the views of Bouldin Island from SR 12. Agricultural activities would continue, consistent with current land uses on the project islands. **No effect** would occur.

EFFECT VIS-5 **Reduction in the Quality of Views of the Habitat Islands from Adjacent Waterways.** *Because no new water storage facilities would be constructed on the project islands, there would be no effect on the visual quality from locally-designated scenic waterways.*

No new water storage facilities would be built under the No-Action Alternative. Thus, there would be no potential for reduction in the quality of views of the Habitat Islands from adjacent scenic waterways as a result of the introduction of new built environments into the landscape. **No effect** would occur.

EFFECT VIS-6 **Increase in Opportunities for Recreation Facility Members to View Island Interiors and Other Areas in the Project Vicinity.** *The proposed intensive for-fee hunting program would result in increased viewing opportunities and enhanced vividness of views of the Habitat Island interiors. This effect is beneficial and less than significant.*

An intensive for-fee hunting program would be operated on the project islands, creating an additional 12,000 hunter-use days over existing conditions. Existing recreational and hunting activities already provide opportunities for viewing the island interiors and other areas in the project vicinity. This effect is **beneficial and less than significant**.

Alternative 1 and Alternative 2 (Proposed Action)

The effects analysis and mitigation measures for Alternatives 1 and 2 are the same; therefore, they are described together under this heading.

EFFECT VIS-1 **Reduction in the Quality of Views of Bacon Island and Webb Tract Interiors from Island Levees.** *Project implementation would reduce visual quality on the Reservoir Island interiors, but there are low numbers of sensitive viewers. This effect is less than significant.*

Project implementation would result in conversion of the interior of Bacon Island and Webb Tract from agricultural use to open water or shallow-water wetland vegetation, improvements to existing levees (i.e., replacing vegetation on interior levee slopes with rock revetment), and the construction of intake siphons and discharge pumps along project levees. These project features would reduce the vividness and intactness of interior island views from existing island roads; however, as described above in the “Affected Environment” discussion, there are low numbers of sensitive viewers present on the Reservoir Islands. Therefore, this effect is **less than significant**.

Mitigation Measure: No mitigation is required.

EFFECT VIS-2 **Potential Conflict with Local Scenic Designation for Bacon Island Road.** *Project implementation would introduce a siphon station facility and would remove levee vegetation on Bacon Island; however, this would not result in a substantial adverse effect on the local scenic designation. This effect is less than significant.*

Project implementation would remove vegetation along project levees and introduce rock revetment, and would introduce a siphon station facility into the viewshed of Bacon Island Road—a locally designated scenic corridor (San Joaquin County 1992:VI-6). However, Bacon Island Road would continue to provide access to recreation areas and views of the adjacent waterway, and these criteria are the basis for the Bacon Island Road scenic designation. Levee improvements and the introduction of the project siphon station into the roadway scenic corridor would not result in a substantial adverse effect on the scenic designation. Therefore, this effect is **less than significant**.

Mitigation Measure: No mitigation is required.

EFFECT VIS-3 **Reduction in the Quality of Views of Bacon Island and Webb Tract from Adjacent Waterways and from the Santa Fe Railways Amtrak Line.** *Project implementation would change views of Reservoir Island levees from adjacent waterways and from the Santa Fe Railways Amtrak Line for high numbers of sensitive viewers. This effect is significant.*

Project implementation would substantially reduce the intactness and unity of highly sensitive views of the island levees from adjacent waterways, including locally designated scenic waterways around Bacon Island and Webb Tract (San Joaquin County 1992:VI-6 and Contra Costa County 2005:9-4 through 9-6), by removing vegetation and introducing rock revetment, siphon stations, and pump stations along project levees. Views from the Santa Fe rail line along the south side of Bacon Island, which are traveled by passengers of Amtrak, would be similarly affected. This effect is **significant**.

Mitigation Measure VIS-MM-1: Partially Screen Proposed Pump and Siphon Stations from Important Viewing Areas.

The project applicant will, consistent with flood control and levee or facility maintenance requirements, establish screening that could consist of native trees, shrubs, landscape berms, and ground covers between the project facilities and designated scenic waterways. The project applicant will implement landscape berms near structures to provide partial screening and better connect the buildings visually to the site and the area. Screening vegetation will be planted in locations and at a density that will provide at least a 50% visual screen after 5 years.

Mitigation Measure VIS-MM-2: Design Levee Improvements, Siphon and Pump Stations, and Maintenance Boat Docks to Be Consistent with the Surrounding Landscape.

The project applicant will require that pump and siphon station structures be painted in earth tones to blend with the surrounding landscape. Rock revetment material will be selected to blend with the surrounding landscape. The project applicant will limit structure heights and emphasize horizontal features in its design. Boat docks and related structures necessary for maintenance of project facilities will be constructed of natural-appearing materials with subdued, earth-toned colors to blend in with the surrounding environment.

Implementing Mitigation Measures VIS-MM-1 and VIS-MM-2 would reduce the severity and intensity of this adverse effect, but not to a less-than-significant level because project implementation would still introduce built features into a predominantly agricultural and natural landscape. Therefore, this effect would remain significant and unavoidable.

EFFECT VIS-4 **Change in Bouldin Island Views from State Route 12.** *Management of Bouldin Island for wildlife would enhance views. This effect is beneficial and less than significant.*

Under Alternatives 1 and 2, Bouldin Island would be used for habitat preservation, and therefore no water facilities would be constructed. The habitat elements associated with management of Bouldin Island under the CMP would generally improve the vividness of views of the island from SR 12, the only access route on Bouldin Island. (See Appendix B, Draft Compensatory Mitigation Plan [CMP], for detailed descriptions of habitats.) This effect is beneficial and less than significant.

Mitigation Measure: No mitigation is required.

EFFECT VIS-5 **Reduction in the Quality of Views of the Habitat Islands from Adjacent Waterways.** *Management of Bouldin Island and Holland Tract for habitat preservation would not reduce the visual quality from locally designated scenic waterways. This effect is less than significant.*

Under Alternatives 1 and 2, Bouldin Island and Holland Tract would be used for habitat preservation rather than water storage; therefore, water storage facilities would not be constructed on these two Habitat Islands. Instead, limited agricultural practices consistent with habitat maintenance would continue. Habitat preservation would be consistent with the existing visual character of the two Habitat Islands, and therefore would not reduce the unity or intactness of the existing sensitive views from locally designated scenic waterways. Therefore, this effect is **less than significant**.

Mitigation Measure: No mitigation is required.

EFFECT VIS-6 **Increase in Opportunities for Recreation Facility Members to View Island Interiors and Other Areas in the Project Vicinity.** *No new recreation facilities would be constructed. Existing recreation opportunities provide views of the project islands and vicinity. No effect would occur.*

Although no new recreation facilities would be constructed, existing recreation facilities provide views of the project islands and vicinity. In addition, a complex mosaic of wildlife habitats would be established within the interiors of the Habitat Islands that would enhance the vividness of views of the island interiors from the surrounding levees. The opportunities for recreationists to view island interiors and other areas in the project vicinity would be similar to existing conditions; therefore, **no effect** would occur.

Mitigation Measure: No mitigation is required.

Alternative 3

EFFECT VIS-1 **Reduction in the Quality of Views of Bacon Island and Webb Tract Interiors from Island Levees.** *Project implementation would reduce visual quality on the Reservoir Island interiors, but there are low numbers of sensitive viewers. This effect is less than significant.*

Project implementation would result in conversion of the interior of Bacon Island and Webb Tract from agricultural use to open water or shallow-water wetland vegetation, improvements to existing levees (i.e., replacing vegetation on interior levee slopes with rock revetment), and the construction of intake siphons and discharge pumps along project levees. These project features would reduce the vividness and intactness of interior island views from existing island roads; however, as described above in the “Affected Environment” discussion, there are low numbers of sensitive viewers present on the Reservoir Islands. Therefore, this effect is **less than significant**.

Mitigation Measure: No mitigation is required.

EFFECT VIS-2 **Potential Conflict with Local Scenic Designation for Bacon Island Road.** *Project implementation would introduce a siphon station facility and would remove levee vegetation on Bacon Island; however, this would not result in a substantial adverse effect on the local scenic designation. This effect is less than significant.*

Project implementation would remove vegetation along project levees and introduce rock revetment, and would introduce a siphon station facility into the viewshed of Bacon Island Road—a locally designated scenic corridor (San Joaquin County 1992:VI-6). However, Bacon Island Road would continue to provide access to existing recreation areas and views of the adjacent waterway, and these criteria are the basis for the Bacon Island Road scenic designation. Levee improvements and the introduction of the project’s siphon station into the roadway scenic corridor would not result in a substantial adverse effect on the scenic designation. Therefore, this effect is **less than significant**.

Mitigation Measure: No mitigation is required.

EFFECT VIS-3 Reduction in the Quality of Views of Bacon Island and Webb Tract from Adjacent Waterways and from the Santa Fe Railways Amtrak Line. *Project implementation would change views of Reservoir Island levees from adjacent waterways for high numbers of sensitive viewers. This effect is significant.*

Project implementation would substantially reduce the intactness and unity of highly sensitive views of the island levees from adjacent waterways, including locally designated scenic waterways around Bacon Island and Webb Tract (San Joaquin County 1992:VI-6 and Contra Costa County 2005:9-4 through 9-6), by removing vegetation and introducing rock revetment, siphon stations, and pump stations along project levees. Views from the Santa Fe rail line along the south side of Bacon Island would be similarly affected. Therefore, this effect is **significant**.

Mitigation Measure: Implement Mitigation Measure VIS-MM-1 (Partially Screen Proposed Pump and Siphon Stations from Important Viewing Areas).

Mitigation Measure: Implement Mitigation Measure VIS-MM-2 (Design Levee Improvements, Siphon and Pump Stations, and Maintenance Boat Docks to Be Consistent with the Surrounding Landscape).

Implementing Mitigation Measures VIS-MM-1 and VIS-MM-2 would reduce the severity of this effect, but not to a less-than-significant level because a greater amount of built environments would still be introduced into a primarily agricultural and rural landscape. Therefore, this effect would remain **significant and unavoidable**.

EFFECT VIS-4 Change in Views from State Route 12. *Construction of a new levee parallel to SR 12 on Bouldin Island would alter the viewshed. This effect is less than significant.*

Under Alternative 3, enhancement of habitat north of SR 12 as part of the North Bouldin Habitat Area (NBHA) would increase the vividness of views north of SR 12. However, the viewshed south from SR 12 as it crosses Bouldin Island would be substantially altered as a result of project-related construction of a new levee parallel to the highway. Because the portion of SR 12 that is located in the project study area is not designated by Caltrans or San Joaquin County as a scenic roadway, this effect is **less than significant**.

Mitigation Measure: No mitigation is required.

EFFECT VIS-5 Reduction in the Quality of Views of the Habitat Islands from Adjacent Waterways. *Construction of proposed water storage facilities on Bouldin Island and Holland Tract would reduce the visual quality from locally designated scenic waterways. This effect is significant.*

Under Alternative 3, Bouldin Island and Holland Tract would be used primarily for water storage. Only a small portion of Bouldin Island would be used for the NBHA. The water storage facilities would reduce the quality of views of island levees from locally designated scenic waterways. Constructing the water storage facilities and maintenance boat docks would reduce the unity and intactness of the highly sensitive views from adjacent channels by introducing built elements into a generally intact landscape. Implementation of Alternative 3 would also remove vegetation along project levees and introduce rock revetment, and siphon and pump station facilities along Bouldin Island and Holland Tract levees. These changes would substantially reduce the high quality of views from adjacent waterways and other recreation areas that are designated as scenic and sensitive by San Joaquin and Contra Costa Counties. Therefore, this effect is **significant**.

Mitigation Measure: Implement Mitigation Measure VIS-MM-1 (Partially Screen Proposed Pump and Siphon Stations from Important Viewing Areas).

Mitigation Measure: Implement Mitigation Measure VIS-MM-2 (Design Levee Improvements, Siphon and Pump Stations, and Maintenance Boat Docks to Be Consistent with the Surrounding Landscape).

Implementing Mitigation Measures VIS-MM-1 and VIS-MM-2 would reduce the severity of this effect, but not to a less-than-significant level because a greater amount of built environments would be introduced into a primarily agricultural and rural landscape. Therefore, this effect would remain **significant and unavoidable**.

EFFECT VIS-6 Increase in Opportunities for Recreation Facility Members to View Island Interiors and Other Areas in the Project Vicinity. *Project implementation would not change the viewing opportunities in the project vicinity. No effect would occur.*

Although no new recreation facilities would be constructed, existing recreation facilities provide views of the project islands and vicinity. Wildlife habitat established within the NBHA under Alternative 3 would enhance the vividness of views of this portion of the Bouldin Island interior from the adjacent levee. The opportunities for recreationists to view island interiors and other areas in the project vicinity would be similar to existing conditions; therefore, **no effect** would occur.

Mitigation Measure: No mitigation is required.

Table 3.1-1
Comparison of Delta Wetlands Project 2001 FEIS and this SEIS Effects and Mitigation Measures for Aesthetics

2001 FEIS Effects and Mitigation Measures	SEIS Effects and Mitigation Measures
Alternatives 1 and 2 (Proposed Action)	
Impact J-6: Reduction in the Quality of Views of the Reservoir Island Interiors from Island Levees (LTS) **Mitigation:** No mitigation is required.	**Effect VIS-1:** Reduction in the Quality of Views of the Bacon Island and Webb Tract Interiors from Island Levees (LTS) **Mitigation:** No mitigation is required. No change.
Impact J-7: Potential Conflict with the Scenic Designation for Bacon Island Road (LTS) **Mitigation:** No mitigation is required.	**Effect VIS-2:** Potential Conflict with the Local Scenic Designation for Bacon Island Road (LTS) **Mitigation:** No mitigation is required. No change.
Impact J-8: Reduction in the Quality of Views of the Reservoir Islands from Adjacent Waterways and from the Santa Fe Railways Amtrak Line (SU) **Mitigation Measure RJ-1:** Reduce the Number of Outward Boat Slips Located at Recreation Facilities **Mitigation Measure J-1:** Partially Screen Proposed Recreation Facilities and Pump and Siphon Stations from Important Viewing Areas **Mitigation Measure J-2:** Design Levee Improvements, Siphon and Pump Stations, and Recreation Facilities and Boat Docks to Be Consistent with the Surrounding Landscape	**Effect VIS-3:** Reduction in the Quality of Views of Bacon Island and Webb Tract from Adjacent Waterways and from the Santa Fe Railways Amtrak Line (SU) **Mitigation Measure VIS-MM-1:** Partially Screen Proposed Pump and Siphon Stations from Important Viewing Areas **Mitigation Measure VIS-MM-2:** Design Levee Improvements, Siphon and Pump Stations, and Maintenance Boat Docks to Be Consistent with the Surrounding Landscape

Table 3.1-1
Comparison of Delta Wetlands Project 2001 FEIS and this SEIS Effects and Mitigation Measures for Aesthetics

2001 FEIS Effects and Mitigation Measures	SEIS Effects and Mitigation Measures
Impact J-9: Enhanced Views of Bouldin Island from SR 12 (B) **Mitigation:** No mitigation is required.	**Effect VIS-4:** Change in Bouldin Island Views from SR 12 (B and LTS) **Mitigation:** No mitigation is required. No change.
Impact J-10: Reduction in the Quality of Views of the Habitat Islands from Adjacent Waterways (LTS-M) **Mitigation Measure RJ-1:** Reduce the Number of Outward Boat Slips Located at Recreation Facilities **Mitigation Measure J-1:** Partially Screen Proposed Recreation Facilities and Pump and Siphon Stations from Important Viewing Areas **Mitigation Measure J-2:** Design Levee Improvements, Siphon and Pump Stations, and Recreation Facilities and Boat Docks to Be Consistent with the Surrounding Landscape	**Effect VIS-5:** Reduction in the Quality of Views of the Habitat Islands from Adjacent Waterways (LTS-M) **Mitigation Measure VIS-MM-1:** Partially Screen Proposed Pump and Siphon Stations from Important Viewing Areas **Mitigation Measure VIS-MM-2:** Design Levee Improvements, Siphon and Pump Stations, and Maintenance Boat Docks to Be Consistent with the Surrounding Landscape
Impact J-11: Increase in Viewing Opportunities and the Quality of Views of Island Interiors and the Project Vicinity for Recreation Facility Members (B) **Mitigation:** No mitigation is required.	**Effect VIS-6:** Increase in Opportunities for Recreation Facility Members to View Island Interiors and Other Areas in the Project Vicinity (NI) **Mitigation:** No mitigation is required. Since no new recreation facilities would be constructed, this effect analysis has changed.
Alternative 3	
Impact J-16: Reduction in the Quality of Views of Bacon Island and Webb Tract Interiors from Island Levees (LTS) **Mitigation:** No mitigation is required.	**Effect VIS-1:** Reduction in the Quality of Views of Bacon Island and Webb Tract Interiors from Island Levees (LTS) **Mitigation:** No mitigation is required No change.
Impact J-17: Potential Conflict with the Scenic Designation for Bacon Island Road (LTS) **Mitigation:** No mitigation is required.	**Effect VIS-2:** Potential Conflict with the Local Scenic Designation for Bacon Island Road (LTS) **Mitigation:** No mitigation is required. No change.
Impact J-18: Reduction in the Quality of Views of Bacon Island and Webb Tract from Adjacent Waterways and from the Santa Fe Railways Amtrak Line (SU) **Mitigation Measure RJ-1:** Reduce the Number of Outward Boat Slips Located at Recreation Facilities **Mitigation Measure J-1:** Partially Screen Proposed Recreation Facilities and Pump and Siphon Stations from Important Viewing Areas **Mitigation Measure J-2:** Design Levee Improvements, Siphon and Pump Stations, and Recreation Facilities and Boat Docks to Be Consistent with the Surrounding Landscape	**Effect VIS-3:** Reduction in the Quality of Views of Bacon Island and Webb Tract from Adjacent Waterways and from the Santa Fe Railways Amtrak Line (SU) **Mitigation Measure VIS-MM-1:** Partially Screen Proposed Pump and Siphon Stations from Important Viewing Areas **Mitigation Measure VIS-MM-2:** Design Levee Improvements, Siphon and Pump Stations, and Maintenance Boat Docks to Be Consistent with the Surrounding Landscape

Table 3.1-1 Comparison of Delta Wetlands Project 2001 FEIS and this SEIS Effects and Mitigation Measures for Aesthetics	
2001 FEIS Effects and Mitigation Measures	SEIS Effects and Mitigation Measures
Impact J-19: Change in Views Southward from SR 12 (LTS) **Mitigation:** No mitigation is required.	**Effect VIS-4:** Change in Bouldin Island Views from SR 12 (LTS) **Mitigation:** No mitigation is required. No change.
Impact J-21: Reduction in the Quality of Views of Bouldin Island and Holland Tract from Adjacent Waterways (SU) **Mitigation Measure RJ-1:** Reduce the Number of Outward Boat Slips Located at Recreation Facilities **Mitigation Measure J-1:** Partially Screen Proposed Recreation Facilities and Pump and Siphon Stations from Important Viewing Areas **Mitigation Measure J-2:** Design Levee Improvements, Siphon and Pump Stations, and Recreation Facilities and Boat Docks to Be Consistent with the Surrounding Landscape	**Effect VIS-5:** Reduction in the Quality of Views of the Habitat Islands from Adjacent Waterways (SU) **Mitigation Measure VIS-MM-1:** Partially Screen Proposed Pump and Siphon Stations from Important Viewing Areas **Mitigation Measure VIS-MM-2:** Design Levee Improvements, Siphon and Pump Stations, and Maintenance Boat Docks to Be Consistent with the Surrounding Landscape
Impact J-22: Increase in Opportunities for Recreation Facility Members to View Reservoir Island Interiors and Other Areas in the Project Vicinity (B) **Mitigation:** No mitigation is required.	**Effect VIS-6:** Increase in Opportunities for Recreation Facility Members to View Island Interiors and Other Areas in the Project Vicinity (NI) **Mitigation:** No mitigation is required. Since no new recreation facilities would be constructed, this effect analysis has changed.
Notes: Shading denotes changes in the effect, significance conclusion, or mitigation measure from the 2001 FEIS; SU = Significant and unavoidable; LTS = Less than significant; LTS-M = Less than significant with mitigation; NI = No impact; B = Beneficial Sources: ICF 2010:4.9-2 through 4.9-5and AECOM 2014	

3.1.6 SECONDARY AND CUMULATIVE EFFECTS

Secondary and cumulative effects on aesthetics resulting from project implementation were described in the 2001 FEIS (Chapter 3J) and 2010 DEIR (Chapter 5). The 2001 FEIS and 2010 DEIR are herein incorporated by reference, and the effect conclusions and mitigation measures, along with any changes, are summarized briefly below and shown in Table 3.1-2.

REDUCTION IN THE QU ALITY OF VIEWS OF THE RESERVOIR ISLANDS

Project-related visual effects related to levee and infrastructure improvements would be significant and unavoidable for views in and outside the Reservoir Islands. Other development in the Delta could similarly degrade the overall visual quality of the Delta for viewer groups. Therefore, the project's contribution to this cumulatively significant effect is cumulatively considerable.

Mitigation Measure: Implement VIS-MM-1 (Partially Screen Proposed Pump and Siphon Stations from Important Viewing Areas).

Mitigation Measure: Implement VIS-MM-2 (Design Levee Improvements, Siphon and Pump Stations, and Maintenance Boat Docks to Be Consistent with the Surrounding Landscape).

Implementing Mitigation Measures VIS-MM-1 and VIS-MM-2 would reduce the project’s contribution, but not to a less-than-significant level because overall, an increase of built environments into the natural landscape would still occur. Therefore, the cumulative effect on visual resources resulting from implementation of the Delta Wetlands project and other development projects in the Delta is cumulatively significant and unavoidable.

Table 3.1-2
Comparison of Secondary and Cumulative Visual Resources Effects between the 2001 FEIS and this SEIS

2001 FEIS Cumulative Effects and Mitigation Measures	SEIS Cumulative Effects and Mitigation Measures
Changes in Visual Resources (NCC) **Mitigation:** No mitigation is required.	Reduction in the Quality of Views of the Reservoir Islands (CCU) **Mitigation Measure VIS-MM-1:** Partially Screen Proposed Pump and Siphon Stations from Important Viewing Areas **Mitigation Measure VIS-MM-2:** Design Levee Improvements, Siphon and Pump Stations, and Maintenance Boat Docks to Be Consistent with the Surrounding Landscape This cumulative effect has changed; see the revised discussion and new mitigation measures.

Notes: Shading denotes changes in the effect, significance conclusion, or mitigation measure from the 2001 FEIS; CCU = Cumulatively considerable and unavoidable; NCC = Not cumulatively considerable
Sources: ICF 2010:5-33 and AECOM 2014

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3.2 AGRICULTURAL RESOURCES

3.2.1 INTRODUCTION

This section describes recent changes to the existing environmental conditions and regulatory framework of the project study area, summarizes the unchanged affected environment, and describes changed environmental effects related to agricultural resources for the project. A review and update of the 1995 DEIR/EIS agricultural resources assessment was incorporated in the 2001 FEIS. Chapter 3I in the 2001 FEIS provided detailed information regarding agricultural resources associated with the project and in the Sacramento-San Joaquin Delta (Delta) in general. The agricultural resources effects of the project were analyzed most recently in Section 4.8 and Chapter 5 of the 2010 DEIR, which also served as a basis for this analysis. The 1995 DEIR/EIS, 2001 FEIS, and 2010 DEIR are herein incorporated by reference.

The 2001 FEIS concluded that the project alternatives would adversely affect agriculture on the four project islands. Since the 2001 FEIS was prepared, studies have been prepared that call into question the long-term viability of agriculture in the Delta. Sea level rise, seismic risk, continued land subsidence, and increased levee vulnerability in the Delta are all factors that threaten the sustainability of agriculture in the Delta over the long term unless major interventions are made. Project effects on agriculture were reanalyzed in the 2010 DEIR in light of this more recent information as well as in light of changes in the project, which include conservation easements on the habitat islands and identification of designated places of use where project water would benefit agriculture. Although these changes were also considered in this analysis, the conclusions reflected in the 2001 FEIS that the direct conversion of agricultural land to nonagricultural uses under Alternatives 1 and 2 would result in a significant adverse effect has not changed.

There have been minor changes in the “Affected Environment” and “Regulatory Framework/Applicable Laws, Regulations, Plans, and Policies” subsections. However, there have been no changes in the project that result in new significant adverse environmental effects or a substantial increase in the severity of previously identified significant adverse effects on agricultural resources. The project would not have any direct effects on agricultural resources in the places of use. However, indirect effects on agricultural resources at the places of use may result from increased agricultural production as a result of removing a barrier to growth in the places of use. Such effects are fully analyzed by the urban water management plan EIR of each affected place of use. (See Section 4.1.2 in Chapter 4, “Other Statutory Requirements” for a list of the applicable urban water management plans.) Other indirect effects on agricultural resources, if any, associated with the provision of project water to the places of use are addressed in the “Secondary and Cumulative Effects” subsection below and in Chapter 4, “Other Statutory Requirements.”

SUMMARY OF CHANGES, NEW CIRCUMSTANCES, AND NEW INFORMATION

Substantial Changes in the Project

Since the 2001 FEIS, there have been no substantial changes to the project resulting in new significant adverse effects or substantial increase in the severity of effects on agricultural resources. However, several changes in the project, in addition to new information, would result in the reduction of the severity of the agricultural land conversion effect relative to the 2001 FEIS conclusion. These project changes consist of the following issues, which are more fully discussed and described in Chapter 2, “Project Description and Alternatives.”

- An environmental commitment has been added to the project to place conservation easements on Bouldin Island and Holland Tract.
- The project applicant has entered into agreements to provide water to designated places of use consisting of Semitropic, Golden State, Western, and Metropolitan and its member agencies.

- Project water not needed for designated place of use demands would be stored within the Semitropic Groundwater Storage Bank and/or the Antelope Valley Water Bank for later delivery to the designated places of use.

- Project water would be provided to Semitropic to improve the reliability of the existing supplies of water for agricultural irrigation.

- Project water provided to Semitropic, Western, and Metropolitan ultimately would benefit agriculture in those service areas by supplementing existing water supplies.

Finally, the project no longer includes a proposal to construct new recreation facilities on the Reservoir or Habitat Islands; however, this change does not affect the analysis of agricultural resources.

New Circumstances

Since the 2001 FEIS, there have been many additional studies in the Delta and several events that call into question the long-term viability of agriculture in the Delta. The 2001 FEIS assumed that the current infrastructure generally could support the No-Action Alternative (intensive agriculture) through the life of the project (50 years). However, threats to continued agriculture in the Delta such as continued land subsidence, levee instability, sea level rise, seismic risk, and urban encroachment, call into question whether agricultural activities are sustainable within the projected project life.

Agricultural cultivation of peat soils in the Delta has contributed to the subsidence of the majority of Delta islands, especially in the western and central Delta, where the project islands are located. Recent studies confirm that as subsidence continues over time, increased hydrostatic pressure is placed on the surrounding levees, increasing the cost of levee maintenance, water table management, and land loss from seepage and increasing salinity (Trott 2007). Levee failure on deeply subsided islands would damage or destroy agriculture and infrastructure on these islands, as well as threaten water conveyance to agricultural and urban water users in the San Francisco Bay Area, San Joaquin Valley, and southern California. Funding for local levees in the Delta comes primarily from agricultural reclamation district fees and this funding has been insufficient for levee improvements that would meet current standards, leading to a higher risk of levee failure than assumed in the 2001 FEIS (Trott 2007).

The California Department of Water Resources (DWR's) Delta Risk Management Strategy (DRMS) evaluated the potential for catastrophic levee failure and subsequent effects on water supply and concluded that agriculture within the Delta is unsustainable over the long-term if current land and levee management practices continue for the baseline conditions currently existing in the Delta. According to the DRMS Phase 1 report (California Department of Water Resources 2008), a seismic event is the single greatest risk to levee integrity in the Delta. Levees would fail and as many as 20 islands could flood simultaneously. If this were to occur during a time of low-to-moderate fresh water Delta inflow, brackish water from Suisun Marsh would enter the Delta and would compromise local water supplies, as well as state and Federal water project exports, and water could not be used for in-Delta agricultural irrigation (California Department of Water Resources 2008).

A recent paper by Mount and Twiss (2005) estimated that there is a two-in-three chance that 100-year recurrence interval floods or earthquakes will cause catastrophic flooding and substantial change in the Delta by 2050. Continued subsidence on the islands has reduced the stability of Delta levees, increasing the risk of levee failure. Ongoing subsidence coupled with the expected sea level rise over the next 50 years associated with climate change is expected to substantially increase the instability of the current Delta levee network over the baseline conditions assumed in the 2001 FEIS, and will result in increased potential for and consequence of island flooding (Mount and Twiss 2005). The central and west Delta are the zones at highest risk of seismic-induced levee failure (Mount and Twiss 2005).

While there are new circumstances affecting agricultural resources, these changes do not result in new significant adverse effects or increase the severity or intensity of adverse effects.

New Information

There is no new information of substantial importance that would result in an increase in severity of adverse effects on agricultural resources. The key sources of new information pertaining to agricultural resources that were reviewed or used to prepare this section include:

- Contra Costa County Community Development Department 2006 Agricultural Preserves Map (Contra Costa County 2007);
- California Department of Conservation Contra Costa County Important Farmland Map 2008 (California Department of Conservation 2008);
- California Department of Conservation San Joaquin County Important Farmland Map 2006 (California Department of Conservation 2006);
- California Department of Conservation, Division of Land Resource Protection: San Joaquin County Williamson Act Lands 2006;
- U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS) soil survey data for Contra Costa and San Joaquin Counties (Natural Resources Conservation Service 2007a and 2007b);
- California Department of Conservation's important farmland mapping system data; and
- Crop history (2002–2008) for project islands (Delta Wetlands 2008).

SUMMARY OF ENVIRONMENTAL COMMITMENTS

Environmental commitments are measures incorporated by the project applicant as part of the project, meaning they are proposed as elements of the Proposed Action and are therefore considered in conducting the environmental analysis for each resource area of this SEIS. The purpose of environmental commitments is to reflect and incorporate best practices into the project that avoid, minimize, reduce, or offset potential adverse environmental effects. A complete description of the environmental commitments that have been incorporated into the project since the 2001 FEIS is contained in Chapter 2, "Project Description and Alternatives," of this SEIS.

To ensure continued habitat management and agricultural production on the habitat islands, the project applicant has committed to recording conservation easements over Bouldin Island and Holland Tract lands controlled by Delta Wetlands Properties. The easements will be developed to be consistent with the proposed Compensatory Mitigation Plan (CMP) and will be recorded in San Joaquin County and Contra Costa County, respectively.

3.2.2 AFFECTED ENVIRONMENT

Existing conditions on the project islands have been reconsidered in light of updated soil survey data and land production capability assessments, new data on current crop patterns, and changes in Williamson Act Contracts. These changes are presented below.

WILLIAMSON ACT CONTRACTS

Bacon Island

All of Bacon Island was previously under Williamson Act Contracts. These contracts went through the nonrenewal process and expired in December 2012.

Webb Tract

Webb Tract has an approximately 139.2-acre parcel formerly under a Williamson Act Contract. This contract went through the nonrenewal process and expired in November 2012 (Contra Costa County 2007).

Bouldin Island

The entire land area of Bouldin Island was previously under Williamson Act Contracts; however, these contracts went through the nonrenewal process and expired in December 2012.

Holland Tract

Holland Tract has no parcels under Williamson Act Contracts (Contra Costa County 2007).

AGRICULTURAL CROPS AND PRODUCTION LEVELS

The 2001 FEIS used 1988 conditions to describe pre-project agricultural land use as a result of the project's effects on land use during the intervening years. However, crops and planted acreages on the project islands have changed. The analysis for this SEIS is based on updated (2008) conditions used in the 2010 DEIR analysis, which have not substantially changed since that time. Crop yields were estimated using 2007 countywide yield data from Contra Costa and San Joaquin Counties.

Between 1990 and 2001, some land management decisions that changed agricultural land use on the project islands were made in anticipation of project implementation. Land management decisions made since 2001 have resulted in further changes in agricultural land use on the project islands. Current cropping patterns on the islands in many cases are substantially different from 1988 patterns, as shown in Table 3.2-1. For example, in 1988, the production of seed potatoes on Bacon Island accounted for 52.5% of San Joaquin County's production of this crop. However, seed potatoes have not been produced on Bacon Island since 2003.

Bacon Island

Yield and production levels for the crops grown on Bacon Island are shown in Table 3.2-2. Minor differences in crop acreages occur from year to year, depending on market conditions, the status of Federal "set aside" programs, and pest management concerns. Similarly, per-acre yields vary from season to season based on management practices and weather and pest conditions. The production estimates shown in Table 3.2-2 indicate that Bacon Island produced the following percentages of the crops produced in San Joaquin County, based on 2007 countywide production levels in tons: wheat, 4%; corn, 2.3%; and alfalfa, 2.6%; (San Joaquin County Office of the Agricultural Commissioner 2008). Although oats and sunflower were also grown on Bacon Island in 2008, production estimates are not presented here because these crops were not included in the 2007 crop report for San Joaquin County.

Webb Tract

In 2008, an estimated 73% (approximately 4,064 acres) of Webb Tract's total acreage was planted in corn, the only crop grown on Webb Tract in that year (Table 3.2-1). Approximately 87 acres of land were fallowed. Corn and wheat were the two crops grown in recent years (2002–2008) on Webb Tract (Delta Wetland Properties 2008).

The production estimates shown in Table 3.2-2 indicate that Webb Tract produced approximately 55% of the corn crop in Contra Costa County, based on 2007 countywide production levels in tons (Contra Costa County Department of Agriculture 2008).

Table 3.2-1 Agricultural Crop Changes on Project Islands between 1988 and 2008 (Acres)												
	Bacon Island			Webb Tract			Bouldin Island			Holland Tract		
Crop	1988	2008	% Change	1988	2008	% Change	1988	2008	% Change	1988	2008	% Change
Alfalfa	0	1,787	100									
Asparagus	1,043		-100							402		-100
Corn	757	1,914	153	2,128	4,000	88	2,368	4,002	69	226		-100
Fallow	347	14	-96	611	87	-86	685		-100	745		-100
Milo	82		-100									
Oats		207.4	100									
Pasture				58		-100	33		-100	542	2,884	432
Potatoes	1,836		-100									
Rice								623	100			
Sunflower	186	373.6	101				855		-100			
Tomatoes								308	100			
Unknown Crops	155		-100	26		-100						
Vineyard	272		-100									
Wheat		577.5	100	426		-100	1,139		-100	835		-100
Total	**4,678**	**4,873**	**4**	**3,249**	**4,087**	**26**	**5,080**	**4,933**	**-3**	**2,750**	**2,884**	**5**
Sources: ICF 2010 based on Delta Wetlands Properties 2008; adapted by AECOM in 2013												

Bouldin Island

As shown in Table 3.2-1, corn and rice are the dominant crops grown on Bouldin Island; these two crops account for nearly 94% of the island's agricultural acreage and 77% of the island's total acreage. Tomatoes account for approximately 6% of the island's agricultural acreage.

Table 3.2-2 shows yields and production levels for the primary crops grown on Bouldin Island. The production estimates shown in Table 3.2-2 indicate that Bouldin Island produced the following percentages of the crops produced in San Joaquin County, based on 2007 countywide production levels in tons: corn, 5.0%; rice, 11.7%; and tomatoes, 0.6% (San Joaquin County Office of the Agricultural Commissioner 2008).

Holland Tract

Holland Tract is the least intensively farmed island of the four project islands. During the period of 2002–2008, 2,884 acres of Holland Tract were used for pasture each year, an equivalent of approximately 69% of the island's total acreage; none of the island was used for crop production during this period (Delta Wetlands Properties 2008).

Table 3.2-2 Estimated Crop Production on the Project Islands in 2008														
Crop	Bacon Island			Webb Tract			Bouldin Island			Holland Tract[1]			All Islands	
	Acres Planted in 2008	Yield (tons per acre)	Total Yield (tons)	Acres Planted in 2008	Yield (tons per acre)	Total Yield (tons)	Acres Planted in 2008	Yield (tons per acre)	Total Yield (tons)	Acres Planted in 2008	Yield (tons per acre)	Total Yield (tons)	Acres Planted in 2008	Total Yield (tons)
Wheat	578	3.3	1,906										578	1,906
Corn (grain)	1,914	4.73	9,053	4,064	3.88	15,768	4,002	4.73	18,929				9,980	43,751
Alfalfa	1,787	7.5	13,403										1,787	13,403
Rice							623	4.35	2,710				623	2,710
Tomatoes							308	33.97	10,463				308	10,463
Oats	207b												207	0
Sunflower	374b												374	0
Pasture										2,884	N/A	N/A	2,884	N/A
Total	**4,860**			**4,064**			**4,933**			**2,884**			**16,741**	

Notes: N/A = not applicable

Average yields: Average yield data were obtained from San Joaquin County Office of the Agricultural Commissioner 2008; Contra Costa County Department of Agriculture 2008

[1] Acreage and yield shown here includes production of acreage that would be excluded from the project under Alternatives 1 and 2.

[2] Although oats and sunflower were also grown on Bacon Island in 2008, production estimates are not presented here because these crops were not included in the 2007 crop report for San Joaquin County.

Sources: ICF 2010 based on Delta Wetlands Properties 2008; adapted by AECOM in 2013

SOILS AND LAND PRODUCTION CAPABILITIES

Information on soil and agricultural land production capabilities has been updated relative to the 2001 FEIS. In general, the soil types and land production capabilities have not changed substantially. As such, there have been no substantial changes made to the analysis or conclusions based on this update.

Soil information was obtained from soil survey data prepared by NRCS. Acreages by soil units on each island were estimated based on GIS measurements made by ICF (2010) of NRCS soil survey maps. Information on agricultural land production capabilities on the project islands was updated using the California Department of Conservation's (CDC's) Integrated Farm Management (IFM) system; specifically, updates were made to the total acreages on the islands comprising Prime Farmland, Farmland of Statewide Importance, and Unique Farmland based on 2006 CDC IFM maps for San Joaquin and Contra Costa Counties.

Bacon Island

Bacon Island soil types are presented in Table 3.2-3. Two soil types comprise an estimated 73% of Bacon Island, according to GIS measurements of NRCS soils maps. Rindge muck, partially drained with 0–2% slopes, is the dominant soil on Bacon Island, accounting for an estimated 2,360 acres, or 47% of total acreage. Kingile muck, partially drained with 0–2% slopes, accounts for an estimated 1,455 acres, or 26% of total acreage. Both soils have NRCS land capability classifications of III, as do all soils on Bacon Island.

Table 3.2-3 Estimated Acreages of Soil Types on the Project Islands									
Soils	Land Capability Classes[1]	Soil Limitations	Typical Uses	Bacon Island		Bouldin Island		All Islands	
				Acres	Percent of Total	Acres	Percent of Total	Acres	Percent of Total
San Joaquin County Soils									
Peltier mucky clay loam, partially drained, 0 to 2 percent slopes	IIIw-5	Subsidence, high water table, slow permeability	Irrigated row and field crops	0	0.0	14	0.2	14	0.1
Retryde-Peltier complex, 0 to 2 percent slopes	IIIw-2	Subsidence, high water table, slow permeability	Irrigated row and field crops	65	1.1	944	15.7	1,009	5.0
Venice mucky silt loam, overwash, 0 to 2 percent slopes	IIIw-10	Subsidence, high water table	Irrigated row and field crops	0	0.0	210	3.5	210	1.0
Piper sandy loam, partially drained, 0 to 2 percent slopes	IVw-4	Subsidence, low available water capacity, high water table, weakly cemented substratum	Irrigated row and field crops	0	0.0	30	0.5	30	0.1
Shima muck, partially drained, 0 to 2 percent slopes	IIIw-10	Subsidence, high water table	Irrigated row and field crops	0	0.0	21	0.4	21	0.1
Dello loamy sand, partially drained, 0 to 2 percent slopes	IIIw-4	Low available water capacity, severe hazard of soil blowing, high water table	Irrigated row and field crops	0	0.0	20	0.3	20	0.1
Rindge muck, partially drained, 0 to 2 percent slopes	IIIw-10	Subsidence, high water table	Irrigated row and field crops	2,619	47.0	2,360	39.4	4,979	24.8
Kingile muck, partially drained, 0 to 2 percent slopes	IIIw-10	Subsidence, high water table, slow permeability	Irrigated row and field crops	1,455	26.1	153	2.6	1,608	8.0
Kingile-Retryde complex, partially drained, 0 to 2 percent slopes	IIIw-10	Subsidence, high water table, slow permeability	Irrigated row and field crops	480	8.6	0	0.0	480	2.4
Retryde clay loam, partially drained, 0 to 2 percent slopes	IIIw-2	Subsidence, high water table	Irrigated row and field crops	396	7.1	87	1.5	483	2.4
Valdez silt loam, partially drained, 0 to 2 percent slopes	IIIw-2	Subsidence, high water table	Irrigated row and field crops	0	0.0	466	7.8	466	2.3
Rindge mucky silt loam, overwash, 0 to 2 percent slopes	IIIw-10	Subsidence, high water table	Irrigated row and field crops	93	1.7	1,076	17.9	1,169	5.8%
Venice muck, partially drained, 0 to 2 percent slopes	IIIw-10	Subsidence, high water table	Irrigated row and field crops	59	1.0	271	4.5	330	1.6%
Retryde silty clay loam, organic substratum, 0 to 2 percent slopes	IIIw-2	Subsidence, high water table	Irrigated row and field crops	268	4.8	343	5.7	611	3.0%

Table 3.2-3 Estimated Acreages of Soil Types on the Project Islands									
				Bacon Island		Bouldin Island		All Islands	
Soils	Land Capability Classes[1]	Soil Limitations	Typical Uses	Acres	Percent of Total	Acres	Percent of Total	Acres	Percent of Total
Itano silty clay loam, partially drained, 0 to 2 percent slopes	IIIw-2	Subsidence, high water table, acidity	Irrigated row and field crops	135	2.4	0	0.0	135	0.7%
Subtotal for Bacon and Bouldin Islands				5,570	100.0	5,995	100.0	11,565	57.7
Contra Costa County Soils									
Rindge muck	IIIw-10	High water table, rapid permeability, moderate soil blowing hazard	Irrigated row crops	1,454	47.4%	4,379	80.9%	5,833	28.8
Piper fine sandy loam	Ive-9	High water table, low available water capacity, rapid permeability, moderate soil blowing hazard	Dryland pasture, small grains, volunteer hay	320	10.4%	264	4.9%	584	2.9
Piper loamy sand	Ivw-4	High water table, low available water capacity, rapid permeability, moderate soil blowing hazard	Irrigated pasture, alfalfa, row crops	455	14.8%	11	0.2%	466	2.3
Ryde silt loam	IIIw-2	High water table	Irrigated row and field crops	62	2.0%	483	8.9%	545	2.7
Egbert mucky clay loam	IIIw-2	High water table	Irrigated field crops and wildlife habitat	15	0.5%	0	0.0%	15	0.1
Shima muck	IIIw-10	High water table, moderate soil blowing hazard	Irrigated row and field crops	644	21.0%	99	1.8%	743	3.7
Kingile muck	IIIw-10	High water table, moderate soil blowing hazard	Irrigated row and field crops	0	0.0%	37	0.7%	37	0.2
Webile muck	IIIw-10	High water table, moderate soil blowing hazard	Irrigated row and field crops	116	3.8	0	0.0%	116	0.6
Merritt loam	IIIw-2	High water table	Irrigated row and field crops	0	0.0	142	2.6%	142	0.7
Subtotal for Holland and Webb Tracts				3,066	100.0	5,415	100.0	8,481	41.9
Total								**20,046**	**100.0**

Table 3.2-3 Estimated Acreages of Soil Types on the Project Islands									
				Bacon Island		Bouldin Island		All Islands	
Soils	Land Capability Classes[1]	Soil Limitations	Typical Uses	Acres	Percent of Total	Acres	Percent of Total	Acres	Percent of Total

Notes: Acreage totals may not correspond with acreages shown elsewhere in this SEIS because of measurement error, rounding error, and water bodies not surveyed on the islands. Acreages do not include non-farmable acres (e.g., ditches, roads, equipment yards, levees). Acreages by soil units were estimated based on GIS measurements performed by ICF (2010)

[1] Soils are categorized by NRCS according to eight classes (I–VIII) depending on the limitations to agricultural use imposed by specific soil and climatic criteria. The higher the class, the more restrictive the limitation. Soils in Class III have more limitations and hazards than those in Classes I and II. They require more difficult or complex conservation practices when cultivated. Soils in Class IV have greater limitations and hazards than those in Class III and require more difficult or complex measures when cultivated. Capability classes are divided into subclasses and capability units. Subclass symbols include “w” for wetness and “e” for erosion problems. Capability unit symbols include “2" for wetness problems; “4" for coarse texture, low water-holding capacity; “5" for fine textures, tillage problems; “9" for low fertility, acidity, or toxics problems; and “10" for very coarse textured substratum.

[2] Acreages for Holland Tract exclude the approximately 1,120 nonproject acres (under Alternatives 1 and 2).

Sources: ICF 2010 based on U.S. Department of Agriculture 2007a and 2007b; adapted by AECOM in 2013

Major limitations of Bacon Island soils include subsidence, a high water table, and slow permeability. Drainage and careful irrigation practices are required for the production of irrigated row and field crops on Bacon Island soils. Fields are irrigated through application of water through siphon pipes from sloughs and channels to a network of canals and ditches on the island. Drainage water must be pumped out continually to prevent flooding by the rising water table that is caused by the constant hydrostatic pressure of the water outside the island levees. The shallow water table, in combination with the organic peat soils, creates a soil condition favorable to the outbreak of plant pathogens and destructive nematodes.

CDC’s IFM for San Joaquin County indicates that virtually all soils on Bacon Island have been classified as prime farmland, approximately 102 acres have been designated farmland of statewide importance, and 10 acres have been designated as farmland of local importance (Table 3.2-4). As discussed in the 2001 FEIS, the soils on Bacon Island have been categorized by NRCS as Class III soils because of the limitations imposed by subsidence and high water table. Class III soils can be categorized by NRCS as prime if the soil limitations are easily solved by agricultural practices, as is often the case with drainage systems for Delta soils. Virtually all of Bacon Island’s soils have been classified as prime because of drainage practices implemented on the island. An estimated 135 acres of Itano silty clay loam have not been classified as prime.

Webb Tract

Rindge muck is the dominant soil on Webb Tract, accounting for an estimated 4,379 acres (81%) of the island’s 5,415 soil acres (Table 3.2-3); Ryde silt loam is the second most common soil found on Webb Tract, accounting for 438 acres. NRCS considers these two soils to be prime. All but an estimated 275 acres (5%) of the island’s soils are categorized as Class III soils. Major limitations of the Webb Tract soils include a high water table, rapid permeability, and a moderate soil-blowing hazard. As on the other project islands, careful drainage and irrigation practices are required for the production of irrigated row and field crops.

The CDC IFM system has designated an estimated 4,374 acres on Webb Tract as Prime Farmland, approximately 127 acres as Farmland of Statewide Importance, approximately 86 acres as Unique Farmland, and approximately 735 acres as Farmland of Local Importance (Table 3.2-4).

Table 3.2-4 Estimated Acreages of Soils in Important Farmland Mapping Categories on the Project Islands										
	Bacon Island		Webb Tract		Bouldin Island		Holland Tract[1]		All Islands	
	Acres	Percent of Total	Acres	Percent of Total	Acres	Percent of Total	Acres	Percent of Total	Acres	Percent of Total
San Joaquin County Soils										
Prime Farmland	5,151	97.9			5,812	99.1			10,963	56.3
Farmland of Statewide Importance	102	1.9			50	0.8			152	0.8
Unique Farmland	0	0.0			4	0.1			4	0.02
Farmland of Local Importance	10	0.2			0	0.0			10	0.05
Contra Costa County Soils										
Prime Farmland			4,374	82.2					4,374	22.5
Farmland of Statewide Importance			127	2.4					127	0.7
Unique Farmland			86	1.6					86	0.4
Farmland of local importance			735	13.8			3,020	100	2,464	19.3
Total	**5,263**	**100.0**	**5,322**	**100.0**	**5,866**	**100.0**	**3,020**	**100.0**	**19,471**	**100.0**

Notes:

[1] Acreages for Holland Tract exclude the approximately 1,120 nonproject acres (under Alternatives 1 and 2).

Sources: ICF 2010 based on California Department of Conservation 2006, 2008. Acreages were estimated based on GIS measurements performed by ICF (2010). Adapted by AECOM in 2013

Bouldin Island

Three soils account for an estimated 73% of the soils on Bouldin Island. Similar to Bacon Island, Rindge muck, partially drained, 0–2% slopes, is the dominant soil on Bouldin Island, accounting for an estimated 2,360 acres (39%) of the total acreage of Bouldin Island (Table 3.2-3). Rindge mucky silt loam (0–2% slopes) and Retryde Peltier complex (0–2% slopes) account for an estimated 18% and 16% of total acreage, respectively. All three soils have NRCS land capability classifications of III.

Major limitations of the Bouldin Island soils are similar to those found on Bacon Island, including subsidence, a high water table, and slow permeability. Necessary drainage practices for crop production on Bouldin Island are the same as those described above for Bacon Island.

All but 30 acres of Bouldin Island have been classified by NRCS as Class III soils. Class III soils are usually not considered prime by NRCS or CDC; however, appropriate drainage and irrigation practices may significantly reduce the limitations of the soil and lead to prime designations for some Class III soils. CDC has classified all but approximately 54 acres of Bouldin Island's farmlands as prime; an estimated 50 acres are classified as Farmland of Statewide Importance, and approximately 4 acres as Unique Farmland (Table 3.2-4).

Holland Tract

Three soils account for an estimated 83% of Holland Tract's 3,066 soil acres: Rindge muck (47%), Piper loamy sand (15%), and Shima muck (21%) (Table 3.9-3). Unlike Bacon Island, Webb Tract, and Bouldin Island, Holland Tract has large areas of Class IV soils, including an estimated 455 acres of Piper loamy sand and approximately 320 acres of Piper fine sandy loam. The remaining soils on Holland Tract are categorized as Class III soils.

Major limitations of Holland Tract soils include a high water table, low available water capacity, rapid permeability, and moderate soil blowing.

All farmland on Holland Tract has been designated by CDC as Farmland of Local Importance (Table 3.2-4).

FARMLAND CONVERSION

Under the Farmland Mapping and Monitoring Program (FMMP), an analysis of agricultural land use and changes in land use throughout California is conducted every other year. Between the years of 1998 and 2008, the amount of prime farmland has steadily decreased primarily due to land use conversions. Table 3.2-5 identifies the acreages of Important Farmland in Contra Costa and San Joaquin Counties from 2002 through 2008. Prime Farmland and Farmland of Statewide Importance demonstrate the greatest declines in acreages from 2002 to 2008. Designation of new areas as Unique Farmland and Farmland of Statewide Importance has resulted in net increases for these categories for San Joaquin County during this timeframe.

Table 3.2-5
Important Farmland Acreage in San Joaquin and Contra Costa Counties

Land Use Category	2002	2004	2006	2008
San Joaquin County				
Prime Farmland	416,307	412,548	407,609	N/A
Farmland of Statewide Importance	92,559	91,225	89,273	N/A
Unique Farmland	61,030	62,534	63,231	N/A
Farmland of Local Importance	56,506	57,808	59,957	N/A
Contra Costa County				
Prime Farmland	33,731	32,024	29,938	26,788
Farmland of Statewide Importance	9,733	8,547	8,092	7,555
Unique Farmland	4,450	3,929	3,589	3,123
Farmland of Local Importance	53,136	52,257	52,071	53,449

Notes: N/A = not available

Sources: ICF 2010 based on California Department of Conservation 2006 and 2008; adapted by AECOM in 2013

3.2.3 REGULATORY FRAMEWORK/APPLICABLE LAWS, REGULATIONS, PLANS, AND POLICIES

Federal applicable laws and regulations are provided because they are required under NEPA. State applicable laws and regulations are provided for informational purposes and to assist with NEPA review. USACE has considered applicable state, regional, and local plans and ordinances as a part of the environmental review process for this SEIS, where applicable.

FEDERAL

There are no Federal plans, policies, regulations, or laws related to agricultural resources that are applicable to the Proposed Action or alternatives under consideration.

STATE

California Department of Conservation Important Farmland Mapping and Monitoring Program

The California Department of Conservation administers the FMMP, which evaluates the quality of farmlands throughout the State of California.

The California Land Conservation (Williamson) Act

The California Land Conservation Act (California Government Code, beginning at Section 51200), also known as the Williamson Act, was adopted in 1965. The Williamson Act allows for the preservation of agricultural and open space lands through property tax incentives and voluntary restrictive use contracts. This program allows property owners to have their property assessed on the basis of its agricultural production rather than at the current market value. The contract may be cancelled if the land is being converted to an incompatible use.

3.2.4 ANALYSIS METHODOLOGY

The agricultural resources effects analysis focuses on the conversion of agricultural land and related changes in agricultural production. Agricultural land conversion effects were evaluated through comparison between conditions under the project alternatives and point-of-reference conditions described in the "Affected Environment" subsection. The project alternatives also were evaluated for their consistency with Williamson Act Contracts.

SIGNIFICANCE CRITERIA

The basis for determining the significance of effects for this analysis is based on professional standards, project-specific criteria developed by the lead agency to address potential effects unique to the project's location and elements, and is informed by the criteria contained in the Environmental Checklist in Appendix G of the State CEQA Guidelines. These thresholds encompass the factors taken into account under NEPA to determine the significance of an action in terms of its context and the intensity of its effects. The Proposed Action or alternatives under consideration would have a significant, adverse effect on agricultural resources if they would do any of the following:

- cause incompatibilities with existing Williamson Act contracts; or
- result in the conversion of prime farmland as classified by the California Department of Conservation or other agricultural land to other nonfarm uses.

In the 2001 FEIS, changes in agriculture-related employment and farm income were evaluated in Chapter 3K, "Economic Conditions and Effects," along with other economic effects potentially associated with implementation of the project alternatives. In that evaluation, employment and income effects generated by the loss of agricultural use of the project islands were assessed to help determine the significance of the loss of agricultural land. For this SEIS, an assessment of the changes in employment and income potentially resulting from changes in agricultural uses of the project islands is considered separately and is contained in Section 3.16, "Socioeconomics."

3.2.5 ENVIRONMENTAL CONSEQUENCES AND MITIGATION MEASURES

EFFECTS ANALYSIS

Effects on land use and agriculture resulting from implementation of the project were described in the 2001 FEIS and are listed in Table 3.2-7. Where there have been no changes to the effects analysis, the 2001 FEIS is incorporated by reference, and the effects conclusions and mitigation measures are briefly summarized.

No-Action Alternative

EFFECT AG-1 **Consistency with Williamson Act Contracts.** *There are no Williamson Act Contracts on any of the four project islands. No effect would occur.*

All of the Williamson Act Contracts that were in effect on Bacon Island, Webb Tract, and Bouldin Island have gone through the nonrenewal process and have expired. Holland Tract has no parcels under Williamson Act Contracts. Furthermore, since the proposed change from agricultural use to water facilities and habitat management would not occur, there would be no conflict even if Williamson Act Contracts were in place. **No effect** would occur.

EFFECT AG-2 **Conversion of Prime Farmland and Other Agricultural Land to Nonfarm Uses.** *Under the No-Action Alternative, no existing agricultural land would be converted to nonfarm uses. No effect would occur.*

Under the No-Action Alternative presented in the 2001 FEIS, more intensive agricultural operations would be implemented on the four project islands. An agricultural consultant made general recommendations concerning agricultural practices, land improvements, and cropping patterns that would improve the farming efficiency on the four project islands (ICF 2001: Chapter 3I). However, given new information and recent conditions in the Delta (e.g., continued subsidence, increased levee vulnerability), it is reasonable to conclude that for the agricultural resources effect analysis, if agriculture were to be intensified under the No-Action Alternative, it likely would be short-lived. However, because these estimates cannot predict with confidence when the agricultural activities would cease to function on the project islands, the 2001 FEIS projections have not changed for purposes of analysis in this SEIS.

As discussed in the 2001 FEIS, in the short term, implementing the No-Action Alternative would increase the amount of land in agricultural production on the project islands from approximately 16,741 acres (including pasture) (Table 3.2-2) under existing conditions to approximately 18,720 acres (ICF 2001: 3I-24). Because it is not possible to predict with confidence when the agricultural activities would cease to function on the project islands, the 2001 FEIS projections have not been changed for purposes of analysis in this SEIS.

Although irrigation and drainage systems would be improved on the project islands to provide for long-term agricultural production, implementation of the No-Action Alternative would not provide additional flood control benefit or create additional levee stability; and it may, as compared to baseline conditions, result in a long-term deterioration of levee stability and an increase, although unquantifiable, in flood risk. Levee stability on the project islands would continue to be as vulnerable to flood, seismic risk, and land subsidence as it is under existing conditions. As discussed in Section 3.9, "Floodplain Management," under the No-Action Alternative, maintenance practices would continue at their current levels as the local Reclamation Districts (RDs) strive to achieve the adopted PL84-99 standard as the preferred Delta island levee geometry; however, the resources of local RDs are limited and are not always adequate to achieve or maintain compliance on an annual basis. Levee failure on subsided islands would impair or damage the islands' agriculture as well as affect the salinity balance of the Delta, which in turn would threaten water conveyance to agricultural in the region and beyond (Trott 2007).

Additionally, lands would likely continue to subside, especially in the central and western Delta where the project islands are located (Mount and Twiss 2005; Lund et al. 2007) and as such would continue to threaten the long-term sustainability of agriculture on the project islands.

Given these considerations, it is unlikely that increasing agricultural production on the project islands under the No-Action Alternative would benefit agriculture-related industries for any long-term period. However, the No-Action Alternative, no conversion of agricultural land to nonfarm uses would occur; thus, there would be **no effect.**

Alternative 1 and Alternative 2 (Proposed Action)

The effects analysis and mitigation measures for Alternatives 1 and 2 are the same; therefore, they are described together under this heading.

EFFECT AG-1 Consistency with Williamson Act Contracts. *There are no Williamson Act Contracts on any of the four project islands. No effect would occur.*

The Williamson Act Contract status of the project islands has changed since the 2001 FEIS was prepared. All of Bacon Island was under Williamson Act Contracts. These contracts went through the nonrenewal process and expired in December 2012. Webb Tract has an approximately 139.2-acre parcel formerly under a Williamson Act Contract. This contract went through the nonrenewal process and expired in November 2012 (Contra Costa County 2007). The entire land area of Bouldin Island was previously under Williamson Act Contracts; however, these contracts went through the nonrenewal process and expired in December 2012. Holland Tract has no parcels under Williamson Act Contracts (Contra Costa County 2007).

Because there are no lands on the project islands that are under Williamson Act Contracts, **no effect** would occur.

Mitigation Measure: No mitigation is required.

EFFECT AG-2 Conversion of Prime Farmland and Other Agricultural Land to Nonfarm Uses. *The project would cause large amounts of existing agricultural land to be converted to nonfarm uses. This effect is significant.*

Bacon Island

Implementation of Alternatives 1 or 2 would remove an estimated 5,570 acres of Class III soils on Bacon Island from agricultural uses for the life of the project (Table 3.2-3). Approximately 5,151 acres of Prime Farmland, approximately 102 acres of Farmland of Statewide Importance, and approximately 10 acres of Local Importance would be converted to nonfarm uses (Table 3.2-6).

An estimated 4,859 acres, excluding approximately 14 acres of fallow land, were in agricultural use on Bacon Island in 2008 (Table 3.2-1). This land represented an estimated 0.64% of harvested acreage in San Joaquin County in 2007 (San Joaquin County Office of the Agricultural Commissioner 2008).

As discussed in the “Affected Environment” subsection, Bacon Island produced the following percentages of the crops produced in San Joaquin County, based on 2007 countywide production levels in tons: wheat, 4%; corn, 2.3%; and alfalfa, 2.6%; (San Joaquin County Office of the Agricultural Commissioner 2008). Although oats and sunflower were also grown on Bacon Island in 2008, production estimates are not presented here because these crops were not included in the 2007 crop report for San Joaquin County. The removal of land on Bacon Island from agricultural uses would reduce the countywide production of these crops. Over the long term, agricultural production on the island may become infeasible even without project implementation because of subsidence and increased likelihood of levee failure (Mount and Twiss 2005; Lund et al. 2007).

Table 3.2-6 Estimated Acreage of Farmland Converted under Alternatives 1 or 2					
Farmland Classification	Bacon Island	Webb Tract	Bouldin Island[1]	Holland Tract[2]	All Islands
San Joaquin County					
Prime Farmland	5,151		2,981		8,132
Farmland of Statewide Importance	102		42		144
Unique Farmland	0		4		4
Farmland of Local Importance	10		0		10
Contra Costa County					
Prime Farmland		4,374		0	4,374
Farmland of Statewide Importance		127		0	127
Unique Farmland		86		0	86
Farmland of Local Importance		735		1,212	1,947
Total	**5,263**	**5,322**	**3,027**	**1,212**	**14,824**

Notes: Inconsistencies in acreages are the result of rounding and conversion of 1995 EIR/EIS and 2000 RDEIR/RDEIS data to GIS.

[1] Under Alternative 1 or 2, approximately 2,831 acres of Prime Farmland, and 8 acres of Farmland of Statewide Importance would be planted in grain crops (corn, wheat, and barley), pasture, and mixed agriculture/seasonal wetlands on Bouldin Island. These acreages are excluded here.

[2] Under Alternative 1 or 2, approximately 1,809 acres of Farmland of Local Importance would be planted in grain crops (corn, wheat, and barley), pasture, and mixed agriculture/seasonal wetlands on Holland Tract. These acreages are excluded here.

Source: ICF 2010:4.8-40; adapted by AECOM in 2013

Webb Tract

Implementation of Alternatives 1 and 2 would remove an estimated 5,140 acres of Class III soils and approximately 275 acres of Class IV soils on Webb Tract from agricultural uses on a long-term basis for the life of the project (Table 3.2-3). Implementation of Alternatives 1 or 2 would convert an estimated 4,374 acres on Webb Tract of Prime Farmland, approximately 127 acres of Farmland of Statewide Importance, approximately 86 acres of Unique farmland, and approximately 735 acres of Farmland of Local Importance to nonagricultural use for the life of the project (Table 3.2-6).

An estimated 4,000 acres, excluding approximately 87 acres of fallow land, were in agricultural use on Webb Tract in 2008 (Table 3.2-1). This land represented an estimated 2% of acreage harvested in Contra Costa County in 2007 (Contra Costa County Department of Agriculture 2008).

Removing the land from agricultural use would result in the loss of agricultural production on Webb Tract for the life of the project. In 2008, Webb Tract produced approximately 55% of Contra Costa County's field corn crop, based on estimated total yield (tons). The loss of Webb Tract's agricultural production would substantially reduce the countywide production of this crop.

Bouldin Island

Implementation of Alternatives 1 and 2 would convert much of Bouldin Island to nonagricultural uses (i.e., wildlife habitat). Approximately 2,831 acres of Prime Farmland and 8 acres of Farmland of Statewide Importance would remain in use as agriculture (grains and pasture) for wildlife habitat, as described below, as part of the draft Habitat Management Plan (CMP). Because it has not yet been determined precisely where each crop would be planted on Bouldin Island, these acreage values as they apply to Important Farmland types are preliminary. In total, approximately 2,981 acres of Prime Farmland, approximately 42 acres of Farmland of Statewide Importance, and approximately 4 acres of Unique Farmland would be converted under Alternatives 1or 2 to nonagricultural use (Table 3.2-6).

In 2008, an estimated 4,933 acres were in agricultural use on Bouldin Island (Table 3.2-2). Under Alternative 1 or 2 as part of the draft CMP, some portions of Bouldin Island would be planted, primarily in grain crops, to enhance wildlife habitat. As shown in Table 3.2-7, an estimated 1,867 acres would be planted in corn, wheat, pasture, and barley; an estimated 1,195 acres would be harvested for sale. Approximately 1,014 acres would be planted as mixed agriculture/seasonal wetland but would not be harvested.

Table 3.2-7
Projected Crop Production on the Habitat Islands under Alternatives 1 and 2

Crop	Bouldin Island				Holland Tract[1]				Total		
	Acres Planted	Acres Harvested[2]	Yield (tons per acre)	Total Yield (tons)	Acres Planted	Acres Harvested[2]	Yield (tons per acre)	Total Yield (tons)	Acres Planted	Acres Harvested[2]	Total Yield (tons)
Corn	1,222	819	4.73	3,874	716	480	3.88	1,862	1,938	1,299	5,736
Wheat[3]	487	244	3.3	805	353	177	1.59	281	840	421	1,087
Barley	26	13	N/A	N/A	38	19	N/A	N/A	64	32	N/A
Pasture	132	119	N/A	N/A	72	65	N/A	N/A	204	184	N/A
Mixed agriculture/ seasonal wetlands[4]	1,014	N/A	N/A	N/A	631	N/A	N/A	N/A	1,645	N/A	N/A
Total	**2,881**	**1,195**			**1,810**	**741**			**4,691**	**1,936**	

Notes: Represents acreages of crops planted for wildlife habitat. No crops would be planted on Bacon Island and Webb Tract. These acreages are based on the draft CMP and may be revised in the final CMP. Inconsistencies in acreages are the result of rounding and conversion of 1995 EIR/EIS and 2000 REIR/REIS data to GIS.

1 Excludes crops grown on the approximately 1,120 acres on nonproject Holland Tract lands.

2 Represents acreages of crops that would be harvested and sold.

3 Includes spring and winter wheat.

4 Acreage devoted to mixed agricultural/seasonal wetland would not be harvested.

Sources: Planted acreage projections: 1995 DEIR/EIS Appendix G3, “Habitat Management Plan for the Delta Wetlands Habitat Islands.” Average yield projections: San Joaquin County Office of the Agricultural Commissioner 2008; Contra Costa County Department of Agriculture 2008; ICF 2010:4.8-41; adapted by AECOM in 2013

The sale of grain crops planted for wildlife habitat would partially offset the loss of agricultural production on Bouldin Island; however, overall crop production on the island would be reduced by implementation of Alternatives 1 or 2. The effect of this alternative on crop production on Bouldin Island consists of the net loss of an estimated 15,344 tons of corn, 2,697 tons of rice, and 8,492 tons of tomatoes, and the net gain of an estimated 805 tons of wheat, 119 acres of pasture, and 13 acres of barley. (San Joaquin County’s 2007 Agricultural Report does not provide production data for barley; therefore, an estimate for the barley yield on Bouldin Island and percentage increase in countywide barley production [i.e., harvested acreage in tons] resulting from the implementation of Alternatives 1 and 2 could not be provided). These crop reductions (based on 2007 countywide production levels) represent approximately 4% of San Joaquin County’s corn crop, 12% of the county’s rice crop, and 0.6% of the county’s tomato crop. The crop gains would represent approximately 2% of the county’s wheat crop, and an unknown percentage of the county's barley crop and harvested pasture (based on 2007 countywide production levels). (San Joaquin County's 2006/2007 agricultural report reports pasture production in combination with range land production, not as a separate crop; therefore, a percentage increase in the county's pasture production resulting from the implementation of Alternatives 1 and 2 and could not be provided.)

Holland Tract

Under Alternatives 1 or 2, portions of Holland Tract would be excluded from the project. Nonproject areas on Holland Tract would consist of marina properties, the estimated 857 acres of parcels on the southwestern corner of the island, the approximately 263-acre Wildlands parcel, and several small parcels along the levee held by outside interests. Approximately 1,179 acres within the project area would be planted in grain crops (corn, wheat, and barley) and pasture to enhance wildlife habitat, with an estimated 741 acres harvested for sale (Table 3.2-7). Approximately 631 acres would be planted as mixed agriculture/seasonal wetlands but would not be harvested.

Implementation of Alternatives 1 and 2 would convert an estimated 1,212 acres of farmland to nonagricultural uses (excluding 1,120 nonproject acres and 1,808 acres planted in grain crops, pasture, and mixed agriculture/seasonal wetlands) (Table 3.2-6). An estimated 1,212 acres of land designated as farmland of local importance by the CDC would be converted to nonagricultural uses on Holland Tract (Table 3.2-6).

An estimated 2,884 acres were used for pasture on Holland Tract in 2008, and no crops were planted (Table 3.2-2). Implementation of Alternative 1 or 2 would change cropping patterns within the project area on Holland Tract and would result in a net increase in crop production because no harvested crops are currently grown on Holland Tract. The harvest and sale of grain crops planted for wildlife habitat under Alternative 1 or 2 would result in the net gain of approximately 1,862 tons of corn, approximately 281 tons of wheat, approximately 19 acres of barley and approximately 184 harvested acres of pasture in Contra Costa County. (Contra Costa County's 2006/2007 agricultural report does not provide production data for barley; therefore, an estimate for the yield and percentage increase in barley on Holland Tract resulting from the implementation of Alternatives 1 and 2 could not be provided.) The crop gains (based on 2007 countywide harvested acreage) would represent approximately 7% of the county's corn crop, 14% of the county's wheat crop, 3% of the county's pasture, and an unknown percentage of the county's barley crop.

In summary, implementation of Alternatives 1 or 2 would convert an estimated 14,824 acres of farmland (Prime and Unique Farmland, and Farmland of Statewide and Local Importance) to nonagricultural uses on the four project islands (Table 3.2-6). As indicated in Table 3.2-7, an estimated 4,691 acres total on Holland Tract and Bouldin Island would be planted in grain crops, pasture, and mixed agriculture/wetlands to enhance wildlife habitat. This acreage is excluded from the total converted acreage, as is the 1,120 nonproject acres on Holland Tract.

The conversion of an estimated 14,824 acres of farmland is significant because it is a substantial acreage and includes 12,506 acres of prime farmland.

The effect of converting Prime Farmland, Farmland of Statewide Importance, Unique Farmland, and Farmland of Local Importance and resulting losses in agricultural production would be attenuated by some of the project features and actions, which are discussed below.

- **Enhancing Sustainability of Agriculture Occurring in the Place of Use.** Agriculture in San Joaquin Valley would benefit under Alternatives 1 and 2 by providing water to designated places of use (Chapter 2, "Project Description and Alternatives"). For example, through its partnership with Semitropic, the project would provide benefits to landowners and agricultural production within Semitropic's service areas. Semitropic provides water to irrigate approximately 140,000 acres for agricultural uses in Kern County. Water delivered to Semitropic from the project would augment Semitropic's groundwater and State Water Project water supplies. Storage of project water within the Semitropic groundwater bank would benefit agricultural operations both within and outside of Semitropic's service area by enhancing water supply reliability and in turn increasing the sustainability of agriculture within the San Joaquin Valley.

- **Restoring Agricultural Production on Project Islands.** As discussed in Chapter 2 "Project Description and Alternatives," agricultural production would be eliminated from project's reservoir islands. However, the conversion of these agricultural lands is not considered irreversible. Once the project ceases operation, the reservoir islands would be made available for agricultural production. Use of the project islands for water storage activities is not expected to have an adverse effect on the productive capabilities of island soils.

- **Enhancing Sustainability of In-Delta Agriculture.** The project's effect on agricultural land would be further offset by the project's environmental commitment to place agricultural production easements on habitat islands (see Chapter 2 "Project Description and Alternatives" and Section 3.2.1 above) and enhancing the stability of levees on project islands. Enhancing the stability of the project's levees would help benefit agriculture by reducing the threat of levee failure on the habitat islands and other islands within the Delta that also support agriculture.

However, despite these project-related benefits which would somewhat offset the negative effects of agricultural land conversion, the direct conversion of agricultural land is a **significant** effect.

Mitigation Measure AG-MM-1: Provide Funding to Semitropic to Further District Goals of Sustaining Agriculture.

During each of the first 10 years of the project operations, the project applicant will provide to the Semitropic Water Storage District $500,000, for a total of $5,000,000. The funding is intended to further Semitropic's goals of sustaining agriculture through the provision of agricultural surface water to farmers within its boundaries at least cost and provide long-term reliability. It would be used for the following purposes:

- Purchase of voluntary conservation easements over Prime Farmland in Semitropic's District.
- Purchase of imported water by Semitropic.
- Development and operation of infrastructure needed to deliver water to and within Semitropic.
- Other purposes consistent with the Semitropic's mission.

This mitigation measure is consistent with Semitropic's authority and does not obligate it to undertake extraterritorial condemnation measures.

Implementation of AG-MM-1 would help to minimize the level of this effect. However, no feasible mitigation is available to fully reduce this effect to a less-than-significant level. Restoring project lands to agricultural uses at the conclusion of the project would ensure that permanent conversion of agricultural land and production could be avoided; however, it would not reduce the long-term conversion of prime and other farmlands during the 50-year life of the project. Therefore, this effect would remain **significant and unavoidable**.

Alternative 3

EFFECT AG-1 Consistency with Williamson Act Contracts. *There are currently no Williamson Act Contracts on any of the four project islands. No effect would occur.*

The Williamson Act Contract status of the project islands has changed since the 2001 FEIS was prepared. As previously discussed under Alternatives 1 and 2 above, all of the prior Williams Act Contracts on the project islands have expired. Because there are no lands on the project islands that are under Williamson Act Contracts, **no effect** would occur.

Mitigation Measure: No mitigation is required.

EFFECT AG-2	**Conversion of Prime Farmland and Other Agricultural Land to Nonfarm Uses.** *The project would cause large amounts of existing agricultural land to be converted to nonfarm uses. This effect is significant.*

Agricultural resource effects of Alternative 3 on Bacon Island and Webb Tract would be the same as those described previously for Alternatives 1 and 2. However, implementation of Alternative 3 would convert an additional approximately 9,588 acres of farmland (Prime and Unique Farmland, and Farmland of Statewide and Local Importance) on Bouldin Island and Holland Tracts to water storage use (Table 3.2-4). Effects due to agricultural land conversion under Alternative 3 would be greater than under Alternatives 1 or 2 because under Alternative 3 no crops would be planted on Holland Tract or Bouldin Island, although as part of the project's environmental commitments, conservation easements would be placed on Bouldin Island and Holland Tract.

Under Alternative 3, no crops would be planted on Bouldin Island and Holland Tract as part of the CMP; therefore, agricultural resource effects caused by land conversion on these islands would not be offset by agricultural production associated with habitat management as under Alternatives 1 or 2, and no conservation easements would apply. Additionally, the estimated 1,120 acres on Holland Tract excluded from the project under Alternatives 1 or 2 would be converted to water storage uses under Alternative 3.

Implementation of Alternative 3 would result in conversion to nonagricultural uses of an estimated 5,866 acres of farmland on Bouldin Island, including an estimated 5,812 acres designated by CDC as Prime Farmland (Table 3.2-4). This conversion of agricultural land would result in the loss of agricultural production from an estimated 4,933 acres under cultivation in 2008 (Table 3.2-2). Bouldin Island produces 11.7% of San Joaquin County's rice crop (based on 2007 countywide production levels), 5.0% of the county's corn crop, and 0.56% of the county's tomato crop. All agricultural production on Bouldin Island would be lost under Alternative 3.

Implementation of Alternative 3 would result in conversion to nonagricultural uses an estimated 3,020 acres of agricultural soils on Holland Tract, including an estimated 1,095 acres designated by CDC as Prime Farmland (Table 3.2-4). Conversion of agricultural land would result in the loss of an estimated 2,884 acres of pasture.

Alternative 3 would convert an estimated 20,718 acres of farmland (Prime and Unique Farmland, and Farmland of Statewide and Local Importance) on the four project islands combined, to nonagricultural uses, including an estimated 16,777 acres of currently harvested cropland and pasture. This conversion amounts to approximately 5,769 acres more than would be converted under Alternatives 1 or 2.

The conversion of agricultural land on the project islands includes conversion of an estimated 15,337 acres of land designated as Prime Farmland by CDC. This acreage represents approximately 3.5 % of the estimated 437,547 acres of Prime Farmland in the two counties combined in 2006 (California Department of Conservation 2006).

The conversion of 16,777 harvested acres of agricultural land (including pasture) represents conversion of approximately 1.7 % of the 956,021 harvested acres (excluding nonirrigated grazing lands) in Contra Costa and San Joaquin Counties in 2007. Production losses would be similar to, but greater than, the effects described previously for Alternatives 1 and 2.

The conversion of an estimated 16,777 acres of farmland is significant because it is a substantial acreage and includes an estimated 15,337 acres of Prime Farmland.

As discussed under Alternatives 1 and 2, the project benefits would help to attenuate the adverse effects of converting prime and other farmlands to other uses. These consist of enhancing the sustainability of agriculture occurring in the place of use, enhancing the sustainability of agriculture within the Delta by improving the stability of the project levees, and eventually restoring agriculture to the project islands.

However, despite these project-related benefits which somewhat offset the negative effects of agricultural land conversation, the direct conversion of agricultural land is a **significant** effect.

Mitigation Measure: Implement Mitigation Measure AG-MM-1 (Provide Funding to Semitropic to Further District Goals of Sustaining Agriculture).

Implementation of AG-MM-1 would help to minimize the level of this effect. However, no feasible mitigation is available to fully reduce this effect to a less-than-significant level. Restoring project lands to agricultural uses at the conclusion of the project would ensure that permanent conversion of agricultural land and production could be avoided; however, it would not reduce the long-term conversion of prime and other farmlands during the 50-year life of the project. Therefore, this effect would remain **significant and unavoidable**.

Table 3.2-8
Comparison of Delta Wetlands Project 2001 FEIS and this SEIS Effects and Mitigation Measures for Agricultural Resources

2001 FEIS Effects and Mitigation Measures	SEIS Effects and Mitigation Measures
Alternatives 1 and 2 (Proposed Action)	
Effect on Williamson Act Contracts (NI) **Mitigation:** No mitigation is required. Evaluated in text; impact not numbered.	**Effect AG-1:** Consistency with Williamson Act Contracts (NI) **Mitigation:** No mitigation is required. This effect analysis has changed, but the conclusion is the same. All of the Williamson Act contracts on the project islands have expired.
Impact I-4: Direct Conversion of Agricultural Land (SU) **Mitigation:** No mitigation is available to reduce this impact to a less-than-significant level	**Effect AG-2:** Conversion of Prime Farmland and Other Agricultural Land to NonFarm Uses (SU) **Mitigation Measure AG-MM-1:** Provide Funding to Semitropic to Further District Goals of Sustaining Agriculture This effect has not changed. A new mitigation measure has been added, but no mitigation is available to fully reduce this effect to a less-than-significant level; however, changes have been incorporated into the project to reduce the severity of the effect.
Alternative 3	
Effect on Williamson Act Contracts (NI) **Mitigation:** No mitigation is required. Evaluated in text; impact not numbered.	**Effect AG-1:** Consistency with Williamson Act Contracts (NI) **Mitigation:** No mitigation is required. This effect analysis has changed, but the conclusion is the same. All of the Williamson Act contracts on the project islands have expired.
Impact I-7: Direct Conversion of Agricultural Land (SU) **Mitigation:** No mitigation is available to reduce this impact to a less-than-significant level.	**Effect AG-2:** Conversion of Prime Farmland and Other Agricultural Land to NonFarm Uses (SU) **Mitigation Measure AG-MM-1:** Provide Funding to Semitropic to Further District Goals of Sustaining Agriculture This effect has not changed. A new mitigation measure has been added, but no mitigation is available to fully reduce this effect to a less-than-significant level; however, changes have been incorporated into the project to reduce the severity of the effect.

Note: Shading denotes changes in the effect, significance conclusion, or mitigation measure from the 2001 FEIS; SU = Significant and unavoidable; NI = No impact

Sources: ICF 2010:4.8-2 through 4.8-3 and AECOM 2013

3.2.6 Secondary and Cumulative Impacts

Secondary and cumulative effects on agricultural resources from implementing the project were described in the 2001 FEIS (Chapter 3I) and the 2010 DEIR (Chapter 5). The 2001 FEIS and 2010 DEIR are herein incorporated by reference, and the effect conclusions and mitigation measures, along with any changes, are summarized briefly below and shown in Table 3.2-9.

Conflicts with Williamson Act Contracts

Implementation of the project would not contribute to cumulative effects related to conflicts with Williamson Act contracts. Although some of the related projects may occur on land held under Williamson Act Contracts, all of the contracts on the four project islands have expired. Therefore, the project would not result in a cumulatively considerable contribution.

Conversion of Prime Farmland and Other Agricultural Land to Nonfarm Uses

Implementation of the project would contribute to the regional conversion of agricultural land. The related projects evaluated for cumulative effects include a number of projects that would convert agricultural lands to nonagricultural uses. Agricultural land conversions could occur through the urban development of Delta islands, levee improvement and flood control projects, or subsidence-reduction programs. The actual amount of agricultural land that may be converted by other projects is not known. Because these totals are not known, this assessment used countywide historical data on agricultural land conversion as a method to put the estimated project conversion in context with conversion trends in Contra Costa and San Joaquin Counties.

The project would result in the conversion of an estimated 14,949 acres of farmland (8,290 acres in San Joaquin County and 6,659 acres in Contra Costa County). In 2006, Contra Costa and San Joaquin Counties had a combined total of approximately 437,547 acres of Prime Farmland; approximately 97,365 acres of Farmland of Statewide Importance; and approximately 66,820 acres of Unique Farmland (Table 3.2-5). The acreage of Prime Farmland affected by the project (13,148 acres) represents approximately 3% of the total Prime Farmland in both counties. Between 1996 and 2006, the combined average annual loss of Prime Farmland for both counties was approximately 3,666 acres per year (California Department of Conservation 2006 and 2008).

The conversion of prime and other agricultural lands by the project and the related projects is a cumulatively significant and unavoidable effect. This effect would be partially offset because the Delta Wetlands project and other projects have the potential to increase water supply and reliability for agricultural uses, which could help maintain lands in agricultural production. Additionally, as part of the environmental commitments described in Chapter 2, “Project Description and Alternatives” and in subsection 3.2.1, conservation easements would be placed on the habitat islands; the inclusion of this environmental commitment would help protect agricultural resources in the region. However, the cumulative conversion of agricultural land would be cumulatively considerable and unavoidable.

No feasible mitigation is available to reduce this effect to a less-than-significant level. It is extremely unlikely that a similar amount of land in the region with similar qualities and productivity could be brought into production to mitigate the effects resulting from the cumulative loss of agricultural land. Counties in the project region generally are losing farmland faster than new land is being brought into production. For example, between 2004 and 2006, approximately 6,618 acres of Important Farmland in San Joaquin County were converted to urban and other uses, while only 2,668 acres of grazing lands and other nonagricultural lands were converted to agricultural land (California Department of Conservation 2006 and 2008).

Table 3.2-9
Comparison of Secondary and Cumulative Agricultural Resources Effects between the 2001 FEIS and this SEIS

2001 FEIS Cumulative Effects and Mitigation Measures	SEIS Cumulative Effects and Mitigation Measures
Effect on Williamson Act Contracts (NCC) **Mitigation:** No mitigation is required. Evaluated in text; impact not numbered.	Conflicts with Williamson Act Contracts (NCC) **Mitigation:** No mitigation is required. This effect analysis has changed, but the conclusion is the same. All of the Williamson Act contracts on the project islands have expired.
Impact I-8: Cumulative Conversion of Agricultural Land (CCU) **Mitigation:** No mitigation is available.	Conversion of Prime Farmland and Other Agricultural Land to NonFarm Uses (CCU) **Mitigation:** No feasible mitigation is available. Changes have been incorporated into the project to reduce the severity of the effect.

Notes: Shading denotes changes in the effect, significance conclusion, or mitigation measure from the 2001 FEIS; CCU = Cumulatively considerable and unavoidable; NCC = Not cumulatively considerable

Sources: ICF 2010:5-33 and AECOM 2013

3.3 AIR QUALITY

3.3.1 INTRODUCTION

This section describes recent changes to the existing environmental conditions and regulatory framework of the project study area, summarizes the unchanged affected environment, and describes changed environmental effects related to air quality for the project. A review and update of the 1995 DEIR/EIS air quality assessment was incorporated in the 2001 FEIS. Chapter 3.0 in the 2001 FEIS provided detailed information regarding air quality associated with the project and in the Sacramento-San Joaquin Delta (Delta) in general. The air quality effects of the project were analyzed most recently in Section 4.13 and Chapter 5.0 of the 2010 DEIR, which also served as a basis for this analysis. The 1995 DEIR/DEIS, 2001 FEIS, and 2010 DEIR are herein incorporated by reference.

The 2001 FEIS and 2010 DEIR concluded that the project alternatives would affect air quality on and in the vicinity of the four project islands. Since that time, there have been minor changes in the “Affected Environment” and “Regulatory Framework/Applicable Laws, Regulations, Plans, and Policies” subsections. However, there have been no changes in the project that result in new significant environmental effects or a substantial increase in the severity or intensity of previously identified effects on air quality.

The 2001 FEIS and 2010 DEIR air quality analyses have been updated in this SEIS to reflect current environmental conditions on and around the project islands. These changes are minor and do not affect the results of the analyses reported in the 2001 FEIS or 2010 DEIR.

Identification of the project’s specific places of use does not affect air quality in any way that alters the conclusions of the 2001 FEIS or 2010 DEIR. The project would have direct effects on air quality due increased energy used to bank project water in the Semitropic Groundwater Storage Bank and the Antelope Valley Water Bank. However, these effects have been fully analyzed in the Semitropic Groundwater Banking Project Final EIR (SCH#1993072024), Semitropic Groundwater Banking Project Stored Water Recovery Unit Final Supplemental EIR (SCH#1999031100), and Antelope Valley Water Bank Final EIR (SCH#2005091117); therefore, they are not analyzed in this SEIS.

Indirect effects on air quality at the places of use may result from increased energy used as a result of removing a barrier to growth in the places of use. Such effects are fully analyzed by the urban water management plan EIR of each affected place of use. The indirect effects on air quality, if any, associated with the provision of project water to the places of use are addressed in the “Secondary and Cumulative Effects” subsection below and in Chapter 4, “Other Statutory Requirements.”

SUMMARY OF CHANGES, NEW CIRCUMSTANCES, AND NEW INFORMATION

Substantial Changes in the Project

Since the 2001 FEIS and 2010 DEIR were completed, there have been no substantial changes in the project resulting in new significant effects or substantial increase in the severity or intensity of effects on air quality. However, the project no longer includes a proposal to construct new recreation facilities on the Reservoir or Habitat Islands; this change to the project results in a reduction and/or elimination of some the previously identified environmental effects. In addition, agricultural activities associated with the No-Action Alternative have been revised to reflect a decrease in fuel consumption activities. The subsequent change in No-Action Alternative emissions associated with the decreased agricultural activities are reflected in this analysis, and are lower than the previous 2010 DEIR estimates.

New Circumstances

Existing air quality conditions are, for the most part, as they were presented in the 2001 FEIS and 2010 DEIR and are herein incorporated by reference. Other changes involve more recent air pollution monitoring data, and updates to the "Regulatory Framework/Applicable Laws, Regulations, Plans, and Policies." The updated ambient air quality pollution concentrations, based on the most current monitoring data and changes to the attainment/nonattainment pollutant status for the San Francisco Bay Area Air Basin (SFBAAB) and the San Joaquin Valley Air Basin (SJVAB), are summarized in Appendix E, Tables E-1 and E-2, and are discussed in the "Regulatory Framework/Applicable Laws, Regulations, Plans, and Policies" subsection below.

Since the 2001 FEIS and 2010 DEIR were prepared, there have been no new circumstances that result in new significant effects or substantial increase in the severity or intensity of effects on air quality. However, one of the national ambient air quality standards (NAAQS) has been updated and is shown in the "Regulatory Framework/Applicable Laws, Regulations, Plans, and Policies" subsection below. Additionally, the updated "Regulatory Framework/Applicable Laws, Regulations, Plans, and Policies" subsection discusses revision of the air quality significance thresholds established by the Bay Area Air Quality Management District (BAAQMD) and the San Joaquin Valley Air Pollution Control District (SJVAPCD); as well as the most recent nonattainment status for the project area with regard to its location in both the SFBAAB and the SJVAB. The applicable general conformity threshold levels based on current attainment levels are shown in the updated "Regulatory Framework/Applicable Laws, Regulations, Plans, and Policies" subsection below.

New Information

There is no new information of substantial importance that would result in an increase in severity or intensity of effects on air quality. However, the most recent air quality monitoring data from the 2010 DEIR for the monitoring stations located closest to the project islands have been updated to provide the most up-to-date monitoring data in the project area. The environmental effects discussion also includes recalculated baseline and alternatives activity levels since the 2001 FEIS. This data has not changed since publication of the 2010 DEIR.

The air quality modeling has been updated for this SEIS to reflect the fact that no new recreation facilities would be constructed under Alternatives 1, 2 (Proposed Action), or 3. The updated modeling results, which also incorporate the most recent air quality models available at the time of this analysis, are contained in Appendix E. The use of more current air quality models (e.g., OFFROAD2011) may result in slight changes to the previous 2010 DEIR emissions estimates in some cases. The project's emissions were evaluated against the applicable thresholds for this SEIS. The emission estimates were based on the updated activity levels and emission factors and emission factor models that have been updated since the 2001 FEIS and developed for the 2010 DEIR.

SUMMARY OF ENVIRONMENTAL COMMITMENTS

Environmental commitments are measures incorporated by the project applicant as part of the project, meaning they are proposed as elements of the Proposed Action and are therefore considered in conducting the environmental analysis for each resource area of this SEIS. The purpose of environmental commitments is to reflect and incorporate best practices into the project that avoid, minimize, reduce, or offset potential adverse environmental effects. A complete description of the environmental commitments that have been incorporated into the project since the 2001 FEIS is contained in Chapter 2, "Project Description and Alternatives," of this SEIS. There are no environmental commitments that would affect the analysis or effect conclusions related to air quality.

3.3.2 AFFECTED ENVIRONMENT

TOPOGRAPHY, METEOROLOGY, AND CLIMATE

The project area is located on the border of Contra Costa and San Joaquin Counties. Specifically, Bacon Island and Bouldin Island are located in San Joaquin County and Holland Tract and Webb Tract are located in Contra Costa County. These counties are part of the SFBAAB and SJVAB, respectively. California's air basins have been created to group together regions that have similar factors that affect air quality. Ambient concentrations of air pollutants are determined by the level of emissions released by pollutant sources and the atmosphere's ability to transport and dilute such emissions. Natural factors that affect transport, dilution, and generation of air pollutants include terrain, wind, atmospheric stability, and the presence of sunlight.

Existing air quality conditions in the project area are determined by such natural factors as topography, meteorology, and climate, in addition to the emissions released by existing air pollutant sources. Thus, because the project area borders on two air basins and would be expected to have some characteristics of and influence from both basins, this analysis presents the existing air quality conditions of both the SFBAAB and the SJVAB. The environmental factors and pollutant sources that affect ambient concentrations of air pollutants are discussed separately.

San Francisco Bay Area Air Basin

The SFBAAB covers approximately 5,540 square miles of complex terrain consisting of coastal mountain ranges, inland valleys, and the San Francisco Bay. The SFBAAB also covers all of Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, and Santa Clara Counties; southern Sonoma County; and southwestern Solano County. The SFBAAB is generally bounded on the west by the Pacific Ocean, on the north by the Coast Ranges, and on the east and south by the Diablo Range. The project area is located in the easternmost portion of the SFBAAB.

Meteorological conditions in the SFBAAB are warm and mainly dry in the summers, and mild and moderately wet in the winters. Marine air has a moderating effect on the climate during much of the year. Winds flow through the Golden Gate from the Pacific Ocean, but direct flow into eastern Alameda County is impeded by the East Bay hills. Marine air is mostly blocked from the area until late afternoons, or days when deep marine inversions develop with strong onshore flows.

Temperatures in eastern Alameda County are typical of the San Francisco Bay Area's inland coast valleys, which are minimally affected by exposure to sea breezes. Typical temperatures during the summer (i.e., from June to August) are in the upper 80s Fahrenheit (°F) during the day and the mid 50s °F at night (Western Regional Climate Center 2012a). In the winter (i.e., from November to February), temperatures are typically in the upper 50s °F and low 60s°F during the day and the upper 30s°F to low 40s°F at night (Western Regional Climate Center 2012a). The project area receives approximately 14 inches of annual precipitation, with most occurring in the winter months (Western Regional Climate Center 2012a).

Because the area's meteorological conditions are conducive to a buildup of air pollutants and to the transport of air pollutants into the area from urbanized portions of both the San Francisco Bay Area and the Central Valley, pollution potential is relatively high. Pollutants emitted in the more urbanized areas of the SFBAAB and transported from urban or industrial areas can contribute to localized air quality problems. The light winds that are common in winter can combine with surface-based inversions caused by the presence of cold air near the surface, thus trapping pollutants such as particulates (e.g., wood smoke) and carbon monoxide (CO). This can lead to localized high concentrations of these pollutants.

San Joaquin Valley Air Basin

The SJVAB, which occupies the southern half of California's Central Valley, is located in both the Sacramento and San Joaquin Valley and foothills and Sacramento and San Joaquin Valley watersheds. Approximately 250 miles long and 35 miles wide on average, the SJVAB is a well-defined climatic region with distinct topographic features on three sides. The Coast Ranges, which have an average elevation of 3,000 feet, are located on the western border of the SJVAB. The San Emigdio Mountains, which are part of the Coast Ranges, and the Tehachapi Mountains, which are part of the Sierra Nevada, are both located in the southern portion of the SJVAB. The Sierra Nevada forms the eastern border of the SJVAB. No topographic feature delineates the northern edge of the basin. The SJVAB can be considered a "bowl" open only to the north.

The SJVAB is basically flat with a downward gradient in terrain to the northwest. Air flows into the SJVAB through the Carquinez Strait, the only breach in the western mountain barrier, and moves across the Delta from the San Francisco Bay Area. The mountains bordering the SJVAB to the east (the Sierra Nevada) create a barrier to airflow, which leads to entrapment of air pollutants when meteorological conditions are unfavorable for transport and dilution. As a result, the SJVAB is highly susceptible to pollutant accumulation over time.

Summer high temperatures are hot, often exceeding 100ºF. The average maximum temperature during the summertime (June to August) near the project area is approximately 90ºF (Western Regional Climate Center 2012b). Winter temperatures are cool to cold, with minimum temperatures often dropping into the upper 30s°F. The average minimum temperature during the wintertime (November to February) is approximately 41ºF (Western Regional Climate Center 2012b). Most precipitation in the SJVAB occurs as rainfall during winter storms. The rare summertime precipitation falls in the form of convective rain showers. The amount of precipitation in the SJVAB decreases from north to south; the project area receives an average of approximately 12 inches per year (Western Regional Climate Center 2012b).

The winds and unstable atmospheric conditions associated with the passage of winter storms result in periods of low air pollution and excellent visibility. Precipitation and fog tend to reduce or limit concentrations of some pollutants. For instance, clouds and fog block sunlight, which is necessary to fuel photochemical reactions that form ozone. Because CO is partially water soluble, precipitation and fog also tend to reduce CO concentrations in the atmosphere. In addition, respirable particulate matter with an aerodynamic diameter of 10 micrometers or less (PM_{10}) can be washed from the atmosphere through wet deposition processes such as rain. However, between winter storms, high pressure and light winds lead to the creation of low-level temperature inversions and stable atmospheric conditions, resulting in the concentration of air pollutants (e.g., CO, PM_{10}).

3.3.3 Regulatory Framework/Applicable Laws, Regulations, Plans, and Policies

Federal applicable laws and regulations are provided because they are required under NEPA. State applicable laws and regulations are provided for informational purposes and to assist with NEPA review. USACE has considered applicable state, regional, and local plans and ordinances as a part of the environmental review process for this SEIS, where applicable.

Federal

No changes have been made to the ozone, CO, nitrogen dioxide (NO_2), sulfur dioxide (SO_2), or PM_{10} NAAQS since the 2010 DEIR. However, the NAAQS for particulate matter with aerodynamic diameter less than 2.5 microns ($PM_{2.5}$) has been modified since 2010. Table 3.3-1 shows the most recent NAAQS standards for all criteria pollutants. For $PM_{2.5}$, the annual average standard has been reduced from 15 micrograms per cubic meter ($\mu g/m^3$) to 12 $\mu g/m^3$. No changes have been made to the California ambient air quality standards (CAAQS) since the 2010 DEIR was prepared.

Pursuant to the 1990 Federal Clean Air Act (CAA) amendments, the U.S. Environmental Protection Agency (EPA) classifies air basins (or portions thereof) as "attainment" or "nonattainment" for each criteria air pollutant, based on whether or not the national standards have been achieved. The project islands are located in Contra Costa County and San Joaquin County and are within the boundaries of the SJVAB and the SFBAAB. All urban

Table 3.3-1
Ambient Air Quality Standards Applicable in California

Pollutant	Averaging Time	CAAQS[1]	NAAQS[2]
Ozone (O_3)	1 hour	0.09 ppm	–
	8 hour	0.070 ppm	0.075 ppm
Carbon monoxide (CO)	1 hour	20 ppm	35 ppm
	8 hour	9.0 ppm	9 ppm
Nitrogen dioxide (NO_2)	1 hour	0.18 ppm	0.100 ppb
	Annual	0.030 ppm	0.053 ppm
Sulfur dioxide (SO_2)	1 hour	0.25 ppm	0.075 ppm
	3 hour	–	0.5 ppm [3]
	24 hour	0.04 ppm	0.14 ppm [4]
	Annual	–	0.03 ppm [4]
Inhalable particulate matter (PM_{10})	24 hour	50 µg/m^3	150 µg/m^3
	Annual	20 µg/m^3	–
Fine particulate matter ($PM_{2.5}$)	24 hour	–	35 µg/m^3
	Annual	12 µg/m^3	**12.0 µg/m^3**
Sulfates	24 hour	25 µg/m^3	–
Lead (Pb)	30 day	1.5 µg/m^3	–
	Calendar quarter	–	1.5 µg/m^3
	Rolling 3-month average	–	0.15 µg/m^3
Hydrogen sulfide	1 hour	0.03 ppm	–
Vinyl chloride	24 hour	0.01 ppm	–

Notes: CAAQS = California ambient air quality standards; NAAQS = national ambient air quality standards; ppm = parts per million by volume; µg/m^3 = micrograms per cubic meter; – = no standard exists; ppb = parts per billion

1 The California ambient air quality standards (CAAQS) for O_3, CO, SO_2 (1-hour and 24-hour), NO_2, PM_{10}, and $PM_{2.5}$ are values not to be exceeded. All other California standards shown are values not to be equaled or exceeded.

2 The national ambient air quality standards (NAAQS), other than O_3 and those based on annual averages, are not to be exceeded more than once a year. The O_3 standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above the standard is equal to or less than 1.

3 The 3-hour national ambient air quality standard for SO_2 is a secondary standard, which has been established to protect public welfare (e.g., visibility, vegetation, and property damage), rather than a primary standard, which are established to protect the public health of the most sensitive receptors.

4 On June 2, 2010, a new 1-hour SO_2 standard was established and the existing 24-hour and annual primary standards were revoked. To attain the 1-hour national standard, the 3-year average of the annual 99th percentile of the 1-hour daily maximum concentrations at each site must not exceed 75 ppb. The 1971 SO_2 national standards (24-hour and annual) remain in effect until 1 year after an area is designated for the 2010 standard, except in areas designated nonattainment for the 1971 standards, the 1971 standards remain in effect until implementation plans to attain or maintain the 2010 standards are approved. It should be noted that SFBAAB and SJVAB both attain the national SO_2 standards.

Sources: California Air Resources Board 2013, U.S. Environmental Protection Agency 2013a areas within the SJVAB and the SFBAAB are classified as maintenance areas, while the nonurbanized areas, including the project islands, are classified as attainment for the CO NAAQS.

The SJVAB is classified as an extreme nonattainment area for the ozone NAAQS and a nonattainment area for the $PM_{2.5}$ NAAQS, but is in attainment (maintenance) for the PM_{10} NAAQS. The SJVAB is classified as an attainment/unclassified (maintenance) area for the CO NAAQS. The SFBAAB is classified as a nonattainment area for the ozone NAAQS, a nonattainment area for the $PM_{2.5}$ NAAQS, and unclassified for the PM_{10} NAAQS. The SFBAAB is classified as an attainment area for the CO NAAQS (Table 3.3-2).

Table 3.3-2
Federal and State Attainment Status for the SJVAB and SFBAAB

Pollutant	San Joaquin Valley Air Basin		San Francisco Bay Area Air Basin	
	Federal	State	Federal	State
1-hour O_3	NA[1]	Nonattainment/Severe	NA[1]	Nonattainment
8-hour O_3	Nonattainment/Extreme[2]	Nonattainment	Nonattainment/Marginal	Nonattainment
NO_2	Attainment/Unclassified	Attainment	Attainment/Unclassified[3]	Attainment
CO	Attainment/unclassified	Attainment/unclassified	Attainment	Attainment
PM_{10}	Attainment[4]	Nonattainment	Unclassified	Nonattainment
$PM_{2.5}$	Nonattainment[5]	Nonattainment	Nonattainment[6]	Nonattainment
Lead	No designation	Attainment	Attainment	Attainment
Sulfates	NA	Attainment	NA	Attainment
Hydrogen Sulfide	NA	Unclassified	NA	Unclassified
Vinyl Chloride	NA	Attainment	NA	–[6]
Visibility Reducing Particles	NA	Unclassified	NA	Unclassified

Notes: SJVAB = San Joaquin Valley Air Basin; SFBAAB = San Francisco Bay Area Air Basin; NA = not applicable; O_3 = ozone; NO_2 = nitrogen dioxide; CO = carbon monoxide; PM_{10} = respirable particulate matter with an aerodynamic diameter of 10 micrometers or less; $PM_{2.5}$ = respirable particulate matter with an aerodynamic diameter of 2.5 micrometers or less

[1] Previously in nonattainment area; no longer subject to the 1-hour standard due to EPA revocation of the 1-hour standard on June 15, 2005. SJVAB was previously designated as extreme nonattainment for the 1-hour ozone standard. Many applicable requirements for extreme 1-hour ozone nonattainment areas continue to apply to SJVAB.

[2] Though the SJVAB was initially classified as serious nonattainment for the 1997 8-hour ozone standard, EPA approved Valley reclassification to extreme nonattainment in the Federal Register on May 5, 2010 (effective June 4, 2010).

[3] The SFBAAB is classified as an attainment area for the federal annual arithmetic mean NO_2 standard.

[4] On September 25, 2008, EPA redesignated the San Joaquin Valley to attainment for the PM_{10} NAAQS and approved the PM_{10} Maintenance Plan.

[5] The Valley is designated nonattainment for the 1997 $PM_{2.5}$ NAAQS. EPA designated the Valley as nonattainment for the 2006 $PM_{2.5}$ NAAQS on November 13, 2009 (effective December 14, 2009).

[6] On January 9, 2013, EPA issued a final rule to determine that the Bay Area attains the 24-hour $PM_{2.5}$ national standard. This EPA rule suspends key SIP requirements as long as monitoring data continues to show that the Bay Area attains the standard. Despite this EPA action, the Bay Area will continue to be designated as “nonattainment” for the national 24-hour $PM_{2.5}$ standard until such time as the BAAQMD submits a “redesignation request” and a “maintenance plan” to EPA, and EPA approves the proposed resdesignation. The SFBAAB is designated as attainment for the $PM_{2.5}$ annual arithmetic mean standard.

[6] No information is available to designate the region for vinyl chloride.

Sources: San Joaquin Valley Air Pollution Control District 2013; Bay Area Air Quality Management District 2013

Appendix E, Tables E-1 and E-2, show air quality monitoring data for 2011 through 2013. Data are included for the closest Delta air quality monitoring stations at 5551 Bethel Island Road, Bethel Island, and 2975 Treat Boulevard, Concord, both in Contra Costa County. The 2010 DEIR included monitoring station data from the 583 West 10th Street monitoring station in Pittsburg; however, that station was closed in 2008. Thus, this updated analysis includes current monitoring station data from the next closest monitoring station to the project study area (i.e., Treat Boulevard in Concord). Currently, monitoring is conducted for ozone, CO, and PM_{10}, but not for $PM_{2.5}$. There were no violations of the CO or PM_{10} NAAQS at either station. However, during this 3-year period, there were 25 violations of the Federal 8-hour ozone NAAQS.

Conformity with State Implementation Plans

General conformity requirements were adopted by Congress as part of the CAAA and were implemented by EPA regulations in the November 30, 1993 Federal Register (40 Code of Federal Regulations [CFR] Sections 6, 51, and 93: *Determining Conformity of General Federal Actions to State or Federal Implementation Plans; Final Rule*). Projects involving Federal funding or Federal approval are required to show conformity with EPA's General Conformity Rule (40 CFR, Part 51, Subpart W). General conformity applies in both Federal nonattainment and maintenance areas. Within these areas, it applies to any Federal action not specifically exempted by the Clean Air Act (CAA) or EPA regulations. General conformity does not apply to projects or actions that are covered by the transportation conformity rule. If a Federal action falls under the general conformity rule, the Federal agency responsible for the action is responsible for making the conformity determination. The purpose of the general conformity program is to ensure that actions taken by the Federal government do not undermine state or local efforts to achieve and maintain NAAQS. Before a Federal action is taken, it must be evaluated for conformity with the state implementation plan (SIP).

Under the general conformity rule, all reasonably foreseeable emissions, both direct and indirect, predicted to result from the action are taken into consideration and must be identified with respect to location and quantity. Direct emissions occur at the same time and place as the action. Indirect emissions are reasonably foreseeable emissions that may occur later in time and/or farther removed from the action; they are subject to conformity if the Federal agency can practicably control them and maintain control through a continuing program responsibility. If it is found that the action would create emissions above the general conformity *de minimis* threshold levels specified in EPA regulations, the action cannot proceed unless mitigation measures are specified that would bring the project into conformance. These *de minimis* thresholds vary from pollutant to pollutant and depend on the attainment status of individual air basins. Based on the NAAQS maintenance and nonattainment designations for the SJVAB and SFBAAB (Table 3.3-2) and shown in Table 3.3-3, the applicable *de minimis* thresholds for this project are 100 tons per year (tpy) of reactive organic gases (ROG) and oxides of nitrogen (NO_X) in the SFBAAB, 10 tons per year (tpy) of ROG and NO_X in the SJVAB, 100 tpy of CO and $PM_{2.5}$ in the SJVAB, and 100 tpy of CO and $PM_{2.5}$ SFBAAB. The SFBAAB and SJVAB are currently designated as unclassified and attainment, respectively, for the PM_{10} NAAQS and therefore the *de minimis* threshold is not applicable for PM_{10} in SFBAAB or SJVAB. However, because both SFBAAB and SJVAB are designated as nonattainment for the PM_{10} CAAQS, the corresponding *de minimis* threshold has been use to evaluate the proposed project for a conservative analysis.

If the project would result in total direct and indirect emissions in excess of the *de minimis* emission rates, it must be demonstrated through conformity determination procedures that the emissions conform to the applicable SIPs for each affected pollutant.

STATE

At the state level, air quality within the region is regulated by the California Air Resources Board (ARB). Similar to the EPA, ARB has developed ambient air quality standards (i.e., CAAQS) for criteria pollutants, as well as hydrogen sulfide, sulfates, vinyl chloride, and visibility reducing particles. Attainment designations from the ARB dictate air quality planning requirements on the local air districts (i.e., BAAQMD and SJVAPCD). The project

Table 3.3-3 **Federal *de minimis* thresholds for the SJVAB and SFBAAB**				
Tons per year	ROG and NO_X	CO	PM_{10}	$PM_{2.5}$
SFBAAB	100	100	100 [1]	100
SJVAB	10	100	100 [1]	100

Notes: SJVAB = San Joaquin Valley Air Basin; SFBAAB = San Francisco Bay Area Air Basin; ROG = Reactive Organic Gases; NOx = nitrogen oxides; CO = carbon monoxide; PM_{10} = respirable particulate matter with an aerodynamic diameter of 10 micrometers or less; $PM_{2.5}$ = respirable particulate matter with an aerodynamic diameter of 2.5 micrometers or less

[1] The SFBAAB and SJVAB are designated as unclassified and attainment for the PM_{10} NAAQS, respectively. However, because both air basins are designated as nonattainment for the PM_{10} CAAQS, the *de minimis* threshold for nonattainment PM_{10} NAAQS areas is used for a conservative analysis.

Source: U.S. Environmental Protection Agency 2013b

area's attainment statuses with respect to CAAQS are shown for informational purposes. The Federal attainment statuses are used to determine *de minimis* thresholds.

No changes have been made to the ozone, CO, NO_2, PM_{10}, or $PM_{2.5}$ CAAQS since the 2010 DEIR. Table 3.3-1 shows the most recent CAAQS for all criteria pollutants.

Under the California Clean Air Act (CCAA), which has been patterned after the Federal CAA, areas are designated as attainment or nonattainment with respect to the state standards. The SJVAB is classified as a severe nonattainment area for the 1-hour ozone CAAQS, nonattainment for the 8-hour ozone CAAQS, and a nonattainment area for the PM_{10} and $PM_{2.5}$ CAAQS, but is attainment for the CO and NO_2 CAAQS. The SFBAAB is classified as a nonattainment area for the ozone CAAQS and a nonattainment area for the PM_{10} and $PM_{2.5}$ CAAQS, but is in attainment for the CO and NO_2 CAAQS.

Appendix E, Tables E-1 and E-2 show no violations of the CO CAAQS at either station. However, during this 3-year period (2006–2008), there were 18 violations of the state 1-hour ozone CAAQS and 16 violations of the state 24-hour PM_{10} CAAQS.

3.3.4 ANALYSIS METHODOLOGY

The methods used to estimate air emissions in the 2001 FEIS and 2010 DEIR were based on the level of existing activity on each island, estimates of future activity on each island assuming no project, and estimates of expected activity on each island for each project alternative based on the published BAAQMD and SJVAB CEQA guidance. This analysis uses the emission estimates developed for the 2010 DEIR, which reflect the most up-to-date estimates of activity levels for existing and future conditions. The activity levels for existing conditions, future No-Action Alternative (2020), and Alternatives 2 (Proposed Action) and 3 are shown in Appendix E, Tables E-3, E-4, E-5, and E-6, respectively. The activity levels for Alternatives 1 and 2 are assumed to be identical for this analysis.

This analysis, consistent with the 2010 DEIR, assumes that the future No-Action Alternative has a lower amount of recreational activities than in the 2001 FEIS. The 2010 DEIR assumed that the future No-Action Alternative would have the same level of agricultural activity under as in the 2001 FEIS, except that the amount of existing agricultural activity would increase slightly on Bacon and Bouldin Islands and drop for Webb and Holland Tracts. For this analysis, agricultural activities under the No-Action Alternative have been refined to reflect lower fuel consumption levels than those assumed for the previous 2010 DEIR. Emissions estimates presented in this analysis reflect those refinements to the recreational and agricultural activity levels of the No-Action Alternative.

This analysis also assumes that Alternatives 1 and 2 would require approximately the same level of construction activity as in the 2001 FEIS and 2010 DEIR, except that Bacon Island would require more borrow material and Bouldin Island and Holland Tract would require less borrow material.

This analysis assumes that operation of Alternatives 1 or 2 would have the same amount of agricultural activity as in the 2001 FEIS and 2010 DEIR.

This analysis assumes that Alternative 3 would require the same level of construction and operational activity as in the 2001 FEIS and 2010 DEIR.

This analysis assumes that no new recreational facilities would be constructed under Alternatives 1, 2, or 3.

Once the activity levels were estimated, the emissions associated with each project alternative's activity level were calculated using the most recent emission factor models available. These models, which included EMFAC2011 and OFFROAD2011, were not available when the 2001 FEIS was prepared. The use of more current and accurate emissions models resulted in slight changes to emissions estimates from the 2010 DEIR.

CONSTRUCTION-RELATED ASSESSMENT METHODS

Construction-related emissions were calculated only for Alternatives 2 and 3 because project-related construction does not occur under existing conditions or under the No-Action Alternative. Alternative 1 construction emissions would be the same as those of Alternative 2 (Proposed Action).

The average amount of CO, ROG, NO_X, PM_{10}, and $PM_{2.5}$ that would be emitted on each island during construction was calculated based on the average number of vehicles and boat trips expected to take place each day, as well as the number of hours of rock placement and the number of cubic yards of earth moved per day. All trips referred to in this chapter are one-way trips, rather than round trips, to avoid confusion.

When the 2001 FEIS was prepared, ambient standards had not yet been set for $PM_{2.5}$. Since 2001, both state and Federal ambient standards have been established and adjusted for $PM_{2.5}$ and the standards for PM_{10} also have been tightened. Although state and Federal ambient standards have now been established, neither the BAAQMD nor SJVAPCD have yet established $PM_{2.5}$ significance thresholds. Consequently, the analysis for this SEIS uses the PM_{10} significance thresholds of 10 tons PM_{10} per year for projects within the SJVAPCD from the SJVAPCD's *Guide for Assessing and Mitigating Air Quality Impacts* and 80 pounds PM_{10} per day for projects within the BAAQMD from BAAQMD's 1999 CEQA Guidelines.

OPERATIONAL ASSESSMENT METHODS

Emissions were estimated for three distinct operational activities: water pumping, recreational trips, and agricultural operations. The 2001 FEIS considered periodic levee maintenance and improvement. However, these activities were dismissed from further impact assessment in the 2010 DEIR because modeling results showed that they did not result in a calculable effect. This analysis relies on the same modeling that was prepared for the 2010 DEIR; therefore, periodic levee maintenance and improvement is also not included in this SEIS. The methods used to estimate emissions for water pumping, recreational trips, and agricultural operations are discussed below.

Pumping

Emissions generated during pumping were calculated only for Alternatives 2 and 3 because discharge pumping of stored water would not be conducted under existing conditions or the No-Action Alternative. Although the amount of discharge under Alternative 1 would be slightly different from the amount of discharge under Alternative 2, Alternative 1 is similar enough to Alternative 2 that little variation in pumping emissions is expected to occur. The project's pumps could be either electrically or diesel-powered. Criteria pollutant pumping emissions were estimated for the diesel-powered pump scenario, and for the proposed mitigation measure to use electricity for pumping.

Recreation

Recreation-related air emissions were calculated only for existing conditions and the No-Action Alternative.

Agriculture

Agriculture emissions were calculated for existing conditions, Alternative 2, and the No-Action Alternative. Agriculture emissions under Alternative 1 would be identical to those of Alternative 2. No agricultural use of the project islands would occur under Alternative 3. Agriculture emission sources include agricultural equipment, nonharvest vehicles, and their associated fuel use. Also, the amount of disturbed acreage was used to estimate fugitive PM_{10} and $PM_{2.5}$ emissions.

SIGNIFICANCE CRITERIA

The basis for determining the significance of effects for this analysis is based on professional standards, project-specific criteria developed by the lead agency to address potential effects unique to the project's location and elements, and is informed by the criteria contained in the Environmental Checklist in Appendix G of the State CEQA Guidelines. These thresholds encompass the factors taken into account under NEPA to determine the significance of an action in terms of its context and the intensity of its effects. The Proposed Action or alternatives under consideration would have a significant, adverse effect on air quality if they would do any of the following:

- Conflict with or obstruct implementation of the applicable air quality plan;
- Violate any air quality standard or contribute substantially to an existing or projected air quality violation;
- Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard (including releasing emissions which exceed quantitative thresholds for ozone precursors); or
- Expose sensitive receptors to substantial pollutant concentrations.

Because project-related emissions cannot be readily quantified in terms of concentration, they are quantified in terms of mass emissions per unit time. Therefore, significance is determined based on threshold quantities rather than by the CAAQS and NAAQS. Table 3.3-4 summarizes all the emission thresholds used in this analysis. Because Bacon Island and Bouldin Island are located in San Joaquin County and Holland Tract and Webb Tract are located in Contra Costa County, this analysis includes significance thresholds from both the SJVAPCD and BAAQMD. Although this is a SEIS for NEPA, the thresholds of significance from the SJVAPCD and BAAQMD represent thresholds that are more stringent than the *de minimis* thresholds, which apply to the project on a Federal level. Therefore, to provide the most conservative analysis of the project's air quality emissions, the project's air quality emissions were also evaluated against the applicable local air district thresholds.

The SJVAPCD's construction and operational thresholds of 10 tpy of ROG and NO_X, and 15 tpy of PM_{10} were used to evaluate the significance of each alternative's emissions. The SJVAPCD has not established significance thresholds for CO or $PM_{2.5}$.

This analysis uses the BAAQMD 1999 CEQA Guidelines to evaluate the project's air quality effects. According to the 1999 BAAQMD CEQA Guidelines, the determination of effect significance with respect to construction emissions should be based on a consideration of if the required control measures will be implemented. If all feasible control measures would be implemented, then air pollutant emissions from effects from construction activities would be considered less than significant. The BAAQMD has identified a set of PM feasible control

Table 3.3-4 Air Quality Thresholds of Significance					
	ROG	NO_X	CO	$PM_{2.5}$	PM_{10}
Construction—SJVAPCD	10 tpy	10 tpy	NA	NA	15 tpy
Construction—BAAQMD	None	None	None	Comply with enhanced mitigation measures	Comply with enhanced mitigation measures
Operation—SJVAPCD	10 tpy	10 tpy	NA	None	None
Operation—BAAQMD	80 ppd, 15 tpy	80 ppd, 15 tpy	NA	None	80 ppd, 15 tpy
Conformity—SJVAB	10 tpy	10 tpy	100 tpy	100 tpy	100 tpy
Conformity—SFBAAB	100 tpy	100 tpy	100 tpy	100 tpy	NA

Notes: ROG = Reactive Organic Gases; NOx = nitrogen oxides; CO = carbon monoxide; $PM_{2.5}$ = respirable particulate matter with an aerodynamic diameter of 2.5 micrometers or less; PM_{10} = respirable particulate matter with an aerodynamic diameter of 10 micrometers or less; SJVAPCD =San Joaquin Valley Air Pollution Control District; tpy = tons per year; BAAQMD = Bay Area Air Quality Management District; NA = not applicable; ppd = pounds per day; SJVAB = San Joaquin Valley Air Basin; SFBAAB = San Francisco Bay Area Air basin

Source: ICF 2010: 4.13-15; adapted by AECOM in 2013

measures that can be reasonably implemented to significantly reduce PM_{10} emissions for construction activities. Some measures should be implemented at all construction sites ("BAAQMD Basic Construction Mitigation Measures"), regardless of size. Additional measures ("Additional Construction Mitigation Measures") should be implemented at larger construction sites (greater than 4 acres), projects with extensive earthmoving operations, or when construction activities are likely to affect nearby sensitive receptors (Bay Area Air Quality Management District 2012). Construction equipment and vehicles also emit CO and ozone precursors; however, these emissions are considered to be included in emission inventory that is the basis for regional air quality plans, and are not expected to impede attainment or maintenance of ozone and CO standards in the SFBAAB (Bay Area Air Quality Management District 1999).The BAAQMD's 1999 CEQA Guidelines established operational thresholds of 15 tpy and 80 pounds per day (ppd) for ROG, NO_X, and PM_{10} (Bay Area Air Quality Management District 1999).

Table 3.3-4 also shows the applicable Federal general conformity *de minimis* thresholds. As discussed earlier, those thresholds are 10 tpy for ROG and NO_X in the SJVAB, and 100 tpy for ROG and NO_X in the SFBAAB. Both the SJVAB and the SFBAAB have a 100 tpy CO conformity threshold. The SFBAAB is in attainment for the Federal PM_{10} standard and nonattainment for the Federal $PM_{2.5}$ standard. Consequently, it does not have a conformity threshold for PM_{10}, but has a *de minimis* threshold of 100 tpy for $PM_{2.5}$. The SJVAB is nonattainment for the Federal $PM_{2.5}$ standard and has a $PM_{2.5}$ conformity threshold of 100 tpy. As described above, because both SFBAAB and SJVAB are designated as nonattainment for the PM_{10} CAAQS, the *de minimis* threshold for nonattainment PM_{10} NAAQS areas has been conservatively used to evaluate the project's PM_{10} emissions.For this analysis, rather than segregate emissions by air basin, the project's total emissions were calculated and compared to the most stringent of either the SJVAPCD or BAAQMD thresholds.

3.3.5 ENVIRONMENTAL CONSEQUENCES AND MITIGATION MEASURES

EFFECTS ANALYSIS

Effects on air quality resulting from project implementation were described in the 2001 FEIS (Chapter 3) and are listed below in Table 3.3-9. Where there have been no changes to the effects analysis or conclusions, the 2001 FEIS is incorporated by reference, and the effects conclusions and mitigation measures are briefly summarized.

It should be noted that Alternatives 1 and 2 include emissions from equipment that would be used to implement and maintain the Habitat Islands. This includes planting, maintenance, and harvesting of agricultural crops on Bouldin Island (to provide Swainson's hawk foraging habitat). Alternative 3, on the other hand, would entail water storage on all four project islands. The emissions that would occur from constructing, operating, and maintaining the Habitat Islands under Alternatives 1 and 2 are included in the effects analysis below, and account for the greater overall level of emissions under Alternatives 1 and 2 as compared to Alternative 3.

No-Action Alternative

EFFECT AIR-1 **Increase in CO Emissions on the Project Islands During Construction.** *No construction activities would occur as part of the No-Action Alternative. Thus, there would be no construction-related increase in CO. No effect would occur.*

No construction activities would occur as part of the No-Action Alternative. Thus, there would be no construction-related increase in CO. **No effect** would occur.

EFFECT AIR-2 **Increase in CO Emissions on the Project Islands During Operation.** *The increased intensity of agricultural activities and for-fee hunting program could generate CO emissions that exceed applicable mass emission thresholds. This effect is less than significant.*

Appendix E, Tables E-9 and E-10, compare CO emissions for the No-Action Alternative to existing conditions. Under the No-Action Alternative, CO emissions would be 1,448 ppd and to 180.5 tpy. However, the project's CO emissions result in a **less-than-significant** effect because the project islands are in a CO attainment area under state and Federal CO standards, and because agricultural activities are not subject to air emissions regulations.

EFFECT AIR-3 **Increase in ROG Emissions on the Project Islands During Construction.** *No construction activities would occur as part of the No-Action Alternative. Thus, there would be no construction-related increase in ROG emissions. No effect would occur.*

No construction activities would occur as part of the No-Action Alternative. Thus, there would be no construction-related increase in ROG emissions. **No effect** would occur.

EFFECT AIR-4 **Increase in ROG Emissions on the Project Islands During Operation.** *Increased intensity of agricultural operations and the for-fee hunting program could generate ozone precursor ROG emissions that exceed applicable mass emissions thresholds. This effect is less than significant.*

Appendix E, Tables E-9 and E-10, compare ROG emissions for the No-Action Alternative to existing conditions. Under the No-Action Alternative, ROG emissions would be 80 ppd and to 10.0 tpy. These emissions would not exceed the 80 ppd BAAQMD ROG threshold or the 10 tpy SJVAPCD ROG threshold. Although the No-Action Alternative's daily ROG emissions would *equal* BAAQMD's threshold of significance, the threshold is based on if a project would generate emissions that *exceed* the threshold (BAAQMD 1999). However, these emissions are provided for informational purposes because agricultural activities are not subject to air emissions regulations. Thus, this effect is **less than significant.**

EFFECT AIR-5 **Increase in NO_X Emissions on the Project Islands During Construction.** *No construction activities would occur as part of the No-Action Alternative. Thus, there would be no construction-related increase in NO_x emissions. No effect would occur.*

No construction activities would occur as part of the No-Action Alternative. Thus, there would be no construction-related increase in NO_x emissions. **No effect** would occur.

EFFECT AIR-6 **Increase in NO_X Emissions on the Project Islands During Operation.** *Increased intensity of agricultural operations and the for-fee hunting program could generate NO_X emissions that exceed applicable mass emissions thresholds. This effect is less than significant.*

Appendix E, Tables E-9 and E-10, compare NO_x emissions for the No-Action Alternative to existing conditions. Under the No-Action Alternative, NO_x emissions would be 357 ppd and to 44.6 tpy. These emissions would exceed both the BAAQMD and SJVAPCD NO_x thresholds. However, agricultural activities are not subject to air emissions regulations. Thus, this effect is **less than significant.**

EFFECT AIR-7 **Increase in PM_{10} Emissions on the Project Islands During Construction.** *No construction activities would occur as part of the No-Action Alternative. Thus, there would be no construction-related increase in PM_{10} emissions. No effect would occur.*

No construction activities would occur as part of the No-Action Alternative. Thus, there would be no construction-related increase in PM_{10} emissions. **No effect** would occur.

EFFECT AIR-8 **Increase in PM_{10} Emissions on the Project Islands During Operation.** *Increased intensity of agricultural operations and the for-fee hunting program could generate PM_{10} emissions that exceed applicable mass emissions thresholds. This effect is less than significant.*

Appendix E, Tables E-9 and E-10, compare PM_{10} emissions for the No-Action Alternative to existing conditions. Under the No-Action Alternative, PM_{10} emissions would be 9,384 ppd and to 26.4 tpy. Although these PM_{10} emissions would exceed the BAAQMD and SJVAPCD PM_{10} thresholds, agricultural activities are not subject to air emissions regulations. This effect would be **less than significant.**

EFFECT AIR-9 **Need for Conformity Analysis and Conflicts with Federal Attainment Planning.** *Agricultural activities are not subject to Federal air quality standards for criteria air pollutants, therefore a conformity analysis is not required. No effect would occur.*

The continuation of agricultural activities under the No-Action Alternative does not constitute a “project” under NEPA and therefore is not subject to the requirements for a conformity analysis under the Federal CAA. **No effect** would occur.

Alternative 1 and Alternative 2 (Proposed Action)

The only difference between Alternatives 1 and 2 is the quantity and frequency of water diversions and discharges. Although pumping operations would be slightly different than Alternative 2, even with the slight difference in pumping emissions, Alternative 1 would have nearly identical effects to those discussed under Alternative 2. Therefore, the effects associated with Alternatives 1 and 2 are discussed together under this heading.

EFFECT AIR-1 **Increase in CO Emissions on the Project Islands During Construction.** *The project’s construction-related activities could generate temporary and short-term CO emissions that exceed applicable mass emission thresholds. This effect is less than significant.*

As shown in Appendix E, Tables E-9 and E-10, Alternatives 1 and 2 would increase CO emissions during construction by 858 ppd and 107.2 tpy. This represents a higher level of CO emissions than was estimated for the 2001 FEIS, primarily because the construction activity levels are higher and because more recent emission factors have been used for this analysis. However, as in the 2001 FEIS, the project’s CO emissions are **less than significant** because the project is in a CO attainment area under state and Federal CO standards. Although implementation of Mitigation Measures AIR-MM-1, AIR-MM-2, and AIR-MM-3 are not required, they would further reduce the level of this temporary and short-term less-than-significant effect.

Mitigation Measure AIR-MM-1: Perform Routine Maintenance of Construction Equipment.

During construction under Alternatives 1 and 2, the primary source of CO emissions and other pollutants, including ROG and NO_X, is the exhaust generated by earthmoving equipment and other construction and transport vehicles. Therefore, construction crews will perform routine maintenance of earthmoving equipment, as well as all other construction and transport vehicles. Routine maintenance involves oil changes and tune-ups performed at least as frequently as recommended by the manufacturers. This measure will be included as a condition of the construction contract and will be enforced by the project applicant through weekly inspection by the construction inspector.

Mitigation Measure AIR-MM-2: Choose Borrow Sites Close to Fill Locations.

Construction crews will take borrow material from appropriate sites located closest to intended fill locations. This measure would reduce the overall amount of equipment and vehicle operation, thereby reducing exhaust emissions of CO and other pollutants, including ROG, NO_X, and PM_{10}. This measure also would reduce the amount of PM_{10} emitted into the air by vehicles traveling over unpaved or dusty surfaces, the main source of PM_{10} emissions during construction. This measure will be included as a condition of the construction contract and will be enforced by the project applicant through weekly inspection by the construction inspector.

Mitigation Measure AIR-MM-3: Prohibit Unnecessary Idling of Construction Equipment Engines.

Construction crews will be prohibited from leaving construction equipment or other vehicle engines idling when not in use for more than 5 minutes. This measure would reduce the amount of CO and other pollutants, including ROG, NO_X, and PM_{10}, emitted in engine exhaust. This measure will be included as a condition of the construction contract and will be enforced by the project applicant through weekly inspection by the construction inspector.

EFFECT AIR-2 Increase in CO Emissions on the Project Islands During Project Operation. *Following construction of the project, long-term operational activities would generate CO emissions that exceed applicable mass emissions thresholds. This effect is less than significant.*

Appendix E, Tables E-9 and E-10, show CO emissions during operation of Alternatives 1 and 2 assuming that water is pumped onto and out of the island reservoirs using diesel powered pumps. The tables show that compared to future No-Action conditions, Alternatives 1 and 2 would result in a net decrease in CO emissions on a daily basis by 708 ppd, and a net decrease on an annual basis by 117 tpy. As described in the 2001 FEIS and 2010 DEIR, because the project area is a CO attainment area under state and Federal standards, this effect is **less than significant**.

Mitigation Measure: No mitigation is required.

EFFECT AIR-3 Increase in ROG Emissions on the Project Islands During Construction. *The project's construction-related activities would generate temporary and short-term ozone precursor ROG emissions that exceed applicable mass emission thresholds. This effect is significant.*

As shown in Appendix E, Tables E-9 and E-10, construction of Alternatives 1 and 2 would generate 199 ppd and 24.9 tpy of ROG. Although these emission estimates are slightly less than in the 2001 FEIS, ROG emissions would exceed the SJVAPCD's annual threshold of 10 tpy. This temporary and short-term construction-related effect is **significant**.

Mitigation Measure: Implement Mitigation Measure AIR-MM-1 (Perform Routine Maintenance of Construction Equipment).

Mitigation Measure: Implement Mitigation Measure AIR-MM-2 (Choose Borrow Sites Close to Fill Locations).

Mitigation Measure: Implement Mitigation Measure AIR-MM-3 (Prohibit Unnecessary Idling of Construction Equipment Engines).

Implementing Mitigation Measures AIR-MM-1, AIR-MM-2, and AIR-MM-3would reduce this temporary and short-term effect, but not to a less-than-significant level because emissions would still exceed the SJVAPCD threshold. No other feasible mitigation measures are available to fully reduce this effect to a less-than-significant level. Therefore, this effect would remain **significant and unavoidable**.

EFFECT AIR-4 Increase in ROG Emissions on the Project Islands During Operation. *Following construction of the project, long-term operational activities would not generate ozone precursor ROG emissions that exceed applicable mass emissions thresholds. This effect is less than significant.*

As shown in Appendix E, Tables E-9 and E-10, the net change in operational ROG emissions from the No-Action Alternative under Alternatives 1 and 2 would be a net increase of 60 ppd and a net decrease of 3.9 tpy. This difference in daily and annual emissions is accounted for by the number and distribution of working days per year. These emissions would not exceed the 80 ppd BAAQMD ROG threshold or the 10 tpy SJVAPCD ROG threshold. Therefore, this effect is **less than significant.**

Mitigation Measure: No mitigation is required.

EFFECT AIR-5 Increase in NO_X Emissions on the Project Islands During Construction. *The project's construction-related activities would generate temporary and short-term ozone precursor NO_X emissions that exceed applicable mass emission thresholds. This effect is significant.*

As shown in Appendix E, Tables E-9 and E-10, construction of Alternatives 1 and 2 would generate 1,614 ppd and 201.8 tpy of NO_X. These estimates are slightly higher than those in the 2001 FEIS, and would also exceed the SJVAPCD's annual threshold of 10 tpy. This temporary and short-term construction-related effect is **significant**.

Mitigation Measure: Implement Mitigation Measure AIR-MM-1 (Perform Routine Maintenance of Construction Equipment).

Mitigation Measure: Implement Mitigation Measure AIR-MM-2 (Choose Borrow Sites Close to Fill Locations).

Mitigation Measure: Implement Mitigation Measure AIR-MM-3 (Prohibit Unnecessary Idling of Construction Equipment Engines).

Implementing Mitigation Measures AIR-MM-1, AIR-MM-2, and AIR-MM-3 would reduce this temporary and short-term effect, but not to a less-than-significant level because emissions would still exceed SJVAPCD thresholds. No other feasible mitigation measures are available to fully reduce this effect to a less-than-significant level. Therefore, this effect would remain **significant and unavoidable**.

EFFECT AIR-6 Increase in NO_X Emissions on the Project Islands During Operation. *Following construction of the project, long-term operational activities would generate ozone precursor NO_X emissions that exceed applicable mass emissions thresholds. This effect is significant.*

As shown in Appendix E, Tables E-9 and E-10, the net increase in operational NO_X emissions as compared to the No-Project Alternative under Alternatives 1 and 2 would be 1,217 ppd and 7.6 tpy. These emissions exceed the BAAQMD threshold, but not the SJVAPCD threshold. Therefore, this effect is **significant**.

Mitigation Measure AIR-MM-4: Coordinate with the SJVAPCD and BAAQMD to Reduce or Offset Emissions.

The project applicant will coordinate with the SJVAPCD and the BAAQMD to implement measures to reduce or offset ROG and NO_X emissions of the project operations. These measures may include implementing a voluntary emission reduction agreement (VERA). The SJVAPCD has encouraged use of a VERA as a means to reduce project emissions.

Mitigation Measure AIR-MM-5: Use Electrically-Powered Pumps in Lieu of Diesel-Powered Pumps.

In the event that Mitigation Measure AIR-MM-4 is not sufficient to fully reduce emissions to a less-than-significant level, electrically-powered pumps will be used in lieu of diesel-powered pumps, which would reduce the increase in operational NO_X emissions to less than the daily and annual significance thresholds.

Implementing Mitigation Measure AIR-MM-4, and if necessary AIR-MM-5, would reduce the effects of project operations related to NO_x emissions to a **less-than-significant** level because emissions would be reduced below BAAQMD threshold (as shown in Appendix E, Tables E-7 and E-8).

EFFECT AIR-7 Increase in PM_{10} Emissions on the Project Islands During Construction. *The project's construction-related activities would generate temporary and short-term PM_{10} emissions that exceed applicable mass emission thresholds. This effect is significant.*

As shown in Appendix E, Tables E-9 and E-10, construction of Alternatives 1 and 2 would generate 731 ppd and 91.4 tpy of PM_{10}. Both the SJVAPCD and the BAAQMD have stated that construction-related PM_{10} emissions are significant, but can be reduced to a less-than-significant level with implementation of appropriate mitigation measures (SJVAPCD 2002 and BAAQMD 1999). Because the SJVAPCD and BAAQMD mitigation measures are not part of the project's design, this temporary and short-term construction-related effect is **significant**.

Mitigation Measure AIR-MM-6: Implement Construction Practices that Reduce Generation of Particulate Matter.

The project applicant will require construction crews to implement the following measures throughout the construction period to reduce generation of particulate matter in the vicinity of construction sites:

- All exposed surfaces (e.g., parking areas, staging areas, soil piles, graded areas, and unpaved access roads) will be watered two times per day.
- All haul trucks transporting soil, sand, or other loose material off-site will be covered.
- All visible mud or dirt track-out onto adjacent public roads will be removed using wet power vacuum street sweepers at least once per day. The use of dry power sweeping is prohibited.
- All vehicle speeds on unpaved roads will be limited to 15 mph.
- Idling times will be minimized either by shutting equipment off when not in use or reducing the maximum idling time to 5 minutes (as required by the California airborne toxics control measure Title

13, Section 2485 of California Code of Regulations). Clear signage will be provided for construction workers at all access points.

- All construction equipment will be maintained and properly tuned in accordance with manufacturer's specifications. All equipment will be checked by a certified visible emissions evaluator.

- Post a publicly visible sign at the soil transfer site within the BAAQMD with the telephone number and person to contact at the lead agency regarding dust complaints. This person will respond and take corrective action within 48 hours. The BAAQMD's phone number will also be visible to ensure compliance with applicable regulations. Pave, apply water three times daily, or apply soil stabilizers on all unpaved access roads, parking areas, and staging areas at construction sites.

- All exposed surfaces will be watered at a frequency adequate to maintain minimum soil moisture of 12%. Moisture content can be verified by lab samples or moisture probe.

- All excavation, grading, and/or demolition activities will be suspended when average wind speeds exceed 20 mph.

- Wind breaks (e.g., trees, fences) will be installed on the windward side(s) of actively disturbed areas of construction. Wind breaks should have at maximum 50% air porosity.

- Vegetative ground cover (e.g., fast-germinating native grass seed) will be planted in disturbed areas as soon as possible and watered appropriately until vegetation is established.

- The simultaneous occurrence of excavation, grading, and ground-disturbing construction activities on the same area at any one time will be limited. Activities will be phased to reduce the amount of disturbed surfaces at any one time.

- All trucks and equipment, including their tires, will be washed off prior to leaving the site.

- Site accesses to a distance of 100 feet from the paved road will be treated with a 6 to 12 inch compacted layer of wood chips, mulch, or gravel.

- Sandbags or other erosion control measures will be installed to prevent silt runoff to public roadways from sites with a slope greater than 1%.

- Minimize the idling time of diesel-powered construction equipment to 2 minutes.

- Develop a plan demonstrating that the off-road equipment (more than 50 horsepower) to be used will achieve a project-wide fleet-average 20% NO_x reduction and 45% PM reduction, compared to the most recent ARB fleet average. Acceptable options for reducing emissions will include the use of late model engines, low-emission diesel products, alternative fuels, engine retrofit technology, after-treatment products, add-on devices such as particulate filters, and/or other options, as they become available.

- Use low volatile organic compounds (i.e., ROG) coatings beyond local requirements (i.e., Regulation 8, Rule 3: Architectural Coatings).

- Require all construction equipment, diesel trucks, and generators be equipped with Best Available Control Technology for emission reductions of NO_x and PM.

- Require all contractors use equipment that meets ARB's most recent certification standard for off-road heavy duty diesel engines.

- These measures will be included as a condition of the construction contract and will be enforced through weekly inspection by the project applicant.

Implementing Mitigation Measure AIR-MM-6 would reduce this temporary and short-term construction-related effect to a **less-than-significant** level by reducing the project's PM_{10} emissions (SJVAPCD 2002 and BAAQMD 1999).

EFFECT AIR-8 **Increase in PM_{10} Emissions on the Project Islands During Operation.** *Following construction of the project, long-term operational activities would not generate PM_{10} emissions that exceed applicable mass emissions thresholds. This effect is less than significant.*

As shown in Appendix E, Tables E-9 and E-10, the net change in operational PM_{10} emissions under Alternatives 1 and 2 from the No-Action Alternative would be a decrease of 8,612 ppd. This decrease occurs because the drop in agricultural activity more than offsets the increase in operational emissions. Alternatives 1 and 2 would also result in a net decrease of 20.8 tpy and would not exceed the SJVPACD's threshold of 15 tpy. Therefore, this effect is **less than significant**.

Mitigation Measure: No mitigation is required.

EFFECT AIR-9 **Need for Conformity Analysis and Conflicts with Federal Attainment Planning.** *Project implementation could conflict with attainment and implementation planning efforts related to Federal air quality standards for criteria air pollutants; therefore, a Federal conformity analysis is required.*

To approve or permit projects, Federal agencies must demonstrate that the approved action does not interfere with applicable attainment planning for criteria air pollutants (42 USC Section 7506[c]). This assessment is known as conformity analysis or general conformity. SMAQMD adopted Federal conformity requirements as a part of the Air District's Rule 104. Conformity means:

> "(A) conformity to an implementation plan's purpose of eliminating or reducing the severity and number of violations of the national ambient air quality standards and achieving expeditious attainment of such standards; and
>
> (B) that such activities will not
>
> (i) cause or contribute to any new violation of any standard in any area;
>
> (ii) increase the frequency or severity of any existing violation of any standard in any area; or
>
> (iii) delay timely attainment of any standard or any required interim emission reductions or other milestones in any area.
>
> The determination of conformity will be based on the most recent estimates of emissions, and such estimates will be determined from the most recent population, employment, travel and congestion estimates as determined by the metropolitan planning organization or other agency authorized to make such estimates (42 USC Section 7506[c][1]).

To determine whether conformity analysis is required, emissions of the action being considered are compared to *de minimis* thresholds that are established based on the severity of the nonattainment classification. The emissions considered are limited to those caused by the Federal action and over which the Federal agency will have control

(40 CFR Section 51.852). For the Delta Wetlands project, this is limited to construction-related emissions. A conformity determination is required if emissions exceed *de minimis* levels.

Table 3.3-5 presents the annual unmitigated construction along with the applicable *de minimis* thresholds. As shown in Table 3.3-5, construction emissions under Alternatives 1 and 2 would exceed the applicable *de minimis* thresholds for NO_X, but not for CO, ROG, PM_{10}, or $PM_{2.5}$.

Mitigation Measure: Implement Mitigation Measure AIR-MM-1 (Perform Routine Maintenance of Construction Equipment).

Mitigation Measure: Implement Mitigation Measure AIR-MM-2 (Choose Borrow Sites Close to Fill Locations).

Mitigation Measure: Implement Mitigation Measure AIR-MM-3 (Prohibit Unnecessary Idling of Construction Equipment Engines).

Mitigation Measure: Implement Mitigation Measure AIR-MM-4 (Coordinate with the SJVAPCD and BAAQMD to Reduce or Offset Emissions).

Mitigation Measure: Implement Mitigation Measure AIR-MM-5 (Use Electrically-Powered Pumps in Lieu of Diesel-Powered Pumps, If Necessary).

Mitigation Measure: Implement Mitigation Measure AIR-MM-6 (Implement Construction Practices that Reduce Generation of Particulate Matter).

Table 3.3-5
Summary of Unmitigated Annual Criteria Air Pollutant and Precursor Emissions Associated with Construction Activities for Alternatives 1 and 2 (Proposed Action)

Source/Year	Emissions (tons/year)				
	VOC/ROG	NO_X	CO	PM_{10}	$PM_{2.5}$
Annual Construction [1]	24.9	201.8	107.2	91.4	37.8
de minimis Threshold [2]	50	50	N/A	100	100
Exceeds *de minimis* Threshold?	No	**Yes**	N/A	No	No

Notes: VOC = volatile organic compounds; ROG = reactive organic gases; NO_X = oxides of nitrogen; CO = carbon monoxide; PM_{10} = particulate matter with an aerodynamic diameter of 10 micrometers or less; $PM_{2.5}$ = particulate matter with an aerodynamic diameter of 2.5 micrometers or less; ( ) = represents negative values or a net decrease in emissions.

1 Alternative 1 and 2 construction emissions were conservatively modeled assuming all construction activities would occur within one calendar year. It possible that construction activities for Alternative 1 and 2 could require up to 1.5 years. However, it is anticipated that even if construction emissions were modeled using a 1.5-year construction schedule, emissions of NO_X shown above would continue to exceed the *de minimis* thresholds, but construction-related annual emissions of CO could potentially be below the *de minimis* threshold. Nevertheless, for a conservative analysis, all construction emissions have been assumed to occur over one year.

2 The *de minimis* thresholds shown represent the most conservative *de minimis* thresholds from either SFBAAB or SJVAB. Several urbanized areas within the SFBAAB and the SJVAB are classified as "CO maintenance areas" that are subject to the Federal conformity thresholds. However, the project is located in rural areas of these air basins that are classified as "CO attainment areas." Therefore, the Federal CO conformity thresholds do not apply to this project.

Sources: Modeling of annual construction emissions performed by Environmental Science Associates in 2014 (see Appendix E to this SEIS); U.S. Environmental Protection Agency 2013b; data compiled by AECOM in 2014

Table 3.3-6 presents the modeled construction and operational emissions of Alternatives 1 and 2 following implementation of the proposed mitigation measures along with the applicable *de minimis* thresholds. As shown in Table 3.3-6, implementation of the mitigation measures would reduce operational-related annual ROG, NO_X, CO, PM_{10}, and $PM_{2.5}$ emissions below the applicable *de minimis* thresholds. However, as also shown in Table 3.3-6, even with implementation of the proposed mitigation measures, construction-related annual emissions under Alternatives 1 and 2 would continue to exceed the applicable *de minimis* thresholds for NO_X. Thus, implementation of either Alternatives 1 or 2 would require a full conformity analysis for construction-related NO_X emissions.

Table 3.3-6
Summary of Mitigated Annual Criteria Air Pollutant and Precursor Emissions Associated with Construction Activities for Alternatives 1 and 2 (Proposed Action)[1]

Source/Year	Emissions (tons/year)				
	VOC/ROG	NO_X	CO	PM_{10}	$PM_{2.5}$
Annual Construction [2]	24.9	201.8	107.2	91.4	37.8
de minimis Threshold [3]	50	50	100	100	100
Exceeds *de minimis* Threshold?	No	**Yes**	No	No	No

Notes: VOC = volatile organic compounds; ROG = reactive organic gases; NO_X = oxides of nitrogen; CO = carbon monoxide; PM_{10} = particulate matter with an aerodynamic diameter of 10 micrometers or less; $PM_{2.5}$ = particulate matter with an aerodynamic diameter of 2.5 micrometers or less; ( ) = represents negative values or a net decrease in emissions.

[1] To be conservative, Table 3.3-6 shows mitigated construction emissions as being equal to the unmitigated levels shown in Table 3.3-5. The reason for this is that the majority of the construction mitigation measures included in the air quality assessment are based on guidance provided by SJVAPCD and/or BAAQMD. Neither air district has developed procedures to calculate how effective many of these measures would be in reducing emissions. Since no guidance is available for estimating mitigation measure effectiveness, mitigated emissions are conservatively shown as being equal to unmitigated.

[2] Alternative 1 and 2 construction emissions were conservatively modeled assuming all construction activities would occur within one calendar year. It possible that construction activities for Alternative 1 and 2 could require up to 1.5 years. However, it is anticipated that even if construction emissions were modeled using a 1.5-year construction schedule, emissions of NO_X shown above would continue to exceed the *de minimis* thresholds, but construction-related annual emissions of CO could potentially be below the *de minimis* threshold. Nevertheless, for a conservative analysis, all construction emissions have been assumed to occur over one year.

[3] The *de minimis* thresholds shown represent the most conservative *de minimis* thresholds from either SFBAAB or SJVAB.

Sources: Modeling of annual construction emissions performed by Environmental Science Associates in 2014 (see Appendix E to this SEIS); U.S. Environmental Protection Agency 2013b; data compiled by AECOM in 2014

Alternative 3

EFFECT AIR-1 Increase in CO Emissions on the Project Islands During Construction. *The project's construction-related activities would generate temporary and short-term CO emissions that exceed applicable mass emission thresholds. This effect is less than significant.*

As shown in Appendix E, Tables E-9 and E-10, Alternative 3 would increase CO emissions during construction by 2,202 ppd and 275.3 tpy. This represents a higher level of CO emissions than was estimated for the 2001 FEIS, primarily because the construction activity levels are higher and more recent emission factors have been used for this analysis. However, as in the 2001 FEIS, the project's CO emissions would be **less than significant** because the project is in a CO attainment area under state and Federal CO standards. Although it is not required, implementing Mitigation Measures AIR-MM-1, AIR-MM-2, and AIR-MM-3would further reduce the level of this already less-than-significant temporary and short-term construction-related effect.

Mitigation Measure: Implement Mitigation Measure AIR-MM-1 (Perform Routine Maintenance of Construction Equipment).

Mitigation Measure: Implement Mitigation Measure AIR-MM-2 (Choose Borrow Sites Close to Fill Locations).

Mitigation Measure: Implement Mitigation Measure AIR-MM-3 (Prohibit Unnecessary Idling of Construction Equipment Engines).

EFFECT AIR-2 Increase in CO Emissions on the Project Islands During Project Operation. *Following construction of the project, long-term operational activities would generate CO emissions that exceed applicable mass emissions thresholds. This effect is less than significant.*

Appendix E, Tables E-9 and E-10, show CO emissions during operation of Alternative 3 assuming that water is pumped onto and out of the island reservoirs using diesel-powered pumps. The net change in CO emissions under Alternative 3 from the No-Action Alternative would be a decrease of 1,197 ppd, and a decrease of 149.4 tpy. This level of CO emissions is substantially lower than the operational CO emission estimates included in the 2001 FEIS because there would be no new recreational facilities. As described in the 2001 FEIS, because the project area is a CO attainment area under state and Federal standards, this effect is **less than significant**.

Mitigation Measure: No mitigation is required.

EFFECT AIR-3 Increase in ROG Emissions on the Project Islands During Construction. *The project's construction-related activities would generate temporary and short-term ozone precursor ROG emissions that exceed applicable mass emission thresholds. This effect is significant.*

As shown in Appendix E, Tables E-9 and E-10, construction of Alternative 3 would generate 527 ppd and 65.9 tpy of ROG. Although these estimates are slightly less than in the 2001 FEIS, ROG emissions would still exceed the SJVAPCD's annual threshold of 10 tpy. This temporary and short-term construction-related effect is **significant**.

Mitigation Measure: Implement Mitigation Measure AIR-MM-1 (Perform Routine Maintenance of Construction Equipment).

Mitigation Measure: Implement Mitigation Measure AIR-MM-2 (Choose Borrow Sites Close to Fill Locations).

Mitigation Measure: Implement Mitigation Measure AIR-MM-3 (Prohibit Unnecessary Idling of Construction Equipment Engines).

Implementing Mitigation Measures AIR-MM-1, AIR-MM-2, and AIR-MM-3 would reduce this effect, but not to a less-than-significant level because emissions would still exceed SJVAPCD thresholds. No other feasible mitigation measures are available to fully reduce this temporary and short-term construction-related effect to a less-than-significant level. Therefore, this effect would remain **significant and unavoidable**.

EFFECT AIR-4 Increase in ROG Emissions on the Project Islands During Operation. *Following construction of the project, long-term operational activities would not generate ozone precursor ROG emissions that exceed applicable mass emissions thresholds. This effect is less than significant.*

As shown in Appendix E, Tables E-9 and E-10, the net change in operational ROG emissions under Alternative 3 from the No-Action Alternative would be a decrease of 30 ppd and decrease of 3.8 tpy. These emission changes would not exceed the 80 ppd BAAQMD ROG threshold or the 10 tpy SJVAPCD ROG threshold. Therefore, this effect is **less than significant**.

Mitigation Measure: No mitigation is required.

EFFECT AIR-5 **Increase in NO_X Emissions on the Project Islands During Construction.** *The project's construction-related activities would generate temporary and short-term ozone precursor NO_X emissions that exceed applicable mass emission thresholds. This effect is significant.*

As shown in Appendix E, Tables E-9 and E-10, construction of Alternative 3 would generate 4,390 ppd and 548.7 tpy of NO_X. Although these estimates are slightly less than in the 2001 FEIS, NO_X emissions would still exceed the BAAQMD and SJVAPCD's thresholds of significance. This temporary and short-term construction-related effect is **significant**.

Mitigation Measure: Implement Mitigation Measure AIR-MM-1 (Perform Routine Maintenance of Construction Equipment).

Mitigation Measure: Implement Mitigation Measure AIR-MM-2 (Choose Borrow Sites Close to Fill Locations).

Mitigation Measure: Implement Mitigation Measure AIR-MM-3 (Prohibit Unnecessary Idling of Construction Equipment Engines).

Implementing Mitigation Measures AIR-MM-1, AIR-MM-2, and AIR-MM-3 would reduce this effect, but not to a less-than-significant level because emissions would still exceed SJVAPCD thresholds. No other feasible mitigation measures are available to fully reduce this temporary and short-term construction-related effect to a less-than-significant level. Therefore, this effect would remain **significant and unavoidable**.

EFFECT AIR-6 **Increase in NO_X Emissions on the Project Islands During Operation.** *Following construction of the project, long-term operational activities would generate ozone precursor NO_X emissions that exceed applicable mass emissions thresholds. This effect is significant.*

As shown in Appendix E, Tables E-9 and E-10, the net increase in operational NO_X emissions as compared to the No-Project Alternative under Alternative 3 would be 197 ppd and 24.7 tpy. These emissions would exceed the 80 ppd BAAQMD NO_X threshold and the 10 tpy SJVAPCD NO_X threshold. This effect is **significant**.

Mitigation Measure: Implement Mitigation Measure AIR-MM-4 (Coordinate with the SJVAPCD and BAAQMD to Reduce or Offset Emissions).

Mitigation Measure: Implement Mitigation Measure AIR-MM-5 (Use Electrically-Powered Pumps in Lieu of Diesel-Powered Pumps, If Necessary).

As shown in Appendix E, Tables E-7 and E-8, implementing Mitigation Measures AIR-MM-4, and if necessary AIR-MM-5, would reduce this effect to a **less-than-significant** level because emissions would be reduced to levels that would be below BAAQMD and SJVAPCD thresholds.

EFFECT AIR-7 **Increase in PM_{10} Emissions on the Project Islands During Construction.** *The project's construction-related activities would generate temporary and short-term PM_{10} emissions that exceed applicable mass emission thresholds. This effect is significant.*

As shown in Appendix E, Tables E-9 and E-10, construction of Alternative 3 would generate 979 ppd and 122.4 tpy of PM_{10}. Both the SJVAPCD and the BAAQMD have stated that construction-related PM_{10} emissions are significant, but can be reduced to a less-than-significant level with implementation of appropriate mitigation measures. Because the SJVAPCD and BAAQMD mitigation measures are not part of the project's design, this temporary and short-term construction-related effect is **significant**.

Mitigation Measure: Implement Mitigation Measure AIR-MM-6 (Implement Construction Practices that Reduce Generation of Particulate Matter).

Implementing Mitigation Measure AIR-MM-6 would reduce this temporary and short-term construction-related effect to a **less-than-significant** level by reducing the project's PM_{10} emissions (SJVAPCD 2002 and BAAQMD 1999).

EFFECT AIR-8 **Increase in PM_{10} Emissions on the Project Islands During Operation.** *Following construction of the project, long-term operational activities would not generate PM_{10} emissions that exceed applicable mass emissions thresholds. This effect is less than significant.*

As shown in Appendix E, Tables E-9 and E-10, the net change in operational PM_{10} emissions under Alternative 3 as compared to the No-Action Alternative would be a decrease of 9,344 ppd. This decrease results because the drop in agricultural activity more than offsets the increase in operational emissions. Alternative 3 would also result in a net decrease of 21.3 tpy. Thus, Alternative 3 operational emissions would not exceed BAAMD or SJVAPCD thresholds of significance. Therefore, this effect is **less than significant**.

Mitigation Measure: No mitigation is required.

EFFECT AIR-9 **Need for Conformity Analysis and Conflicts with Federal Attainment Planning.** *Project implementation could conflict with attainment and implementation planning efforts related to Federal air quality standards for criteria air pollutants; therefore, a Federal conformity analysis would be required.*

To determine whether a conformity analysis is required, emissions of the action being considered are compared to *de minimis* thresholds that are established based on the severity of the nonattainment classification. The emissions considered are limited to those caused by the Federal action and over which the Federal agency will have control (40 CFR Section 51.852). For the Delta Wetlands project, this is limited to construction-related emissions. A conformity determination is required if emissions exceed any *de minimis* thresholds.

Table 3.3-7 presents the annual construction emissions under Alternative 3 along with the applicable *de minimis* thresholds. As shown in Table 3.3-7, the annual construction-related emissions under Alternative 3 would exceed the applicable *de minimis* thresholds for ROG, NO_X, and CO.

Table 3.3-7
Summary of Unmitigated Annual Criteria Air Pollutant and Precursor Emissions Associated with Construction Activities for Alternative 3

Source/Year	Emissions (tons/year)				
	VOC/ROG	NO_X	CO	PM_{10}	$PM_{2.5}$
Annual Construction [1]	65.9	548.7	275.3	122.4	74.6
de minimis Threshold [2]	50	50	100	100	100
Exceeds *de minimis* Threshold?	**Yes**	**Yes**	**Yes**	No	No

Notes: VOC = volatile organic compounds; ROG = reactive organic gases; NO_X = oxides of nitrogen; CO = carbon monoxide; PM_{10} = particulate matter with an aerodynamic diameter of 10 micrometers or less; $PM_{2.5}$ = particulate matter with an aerodynamic diameter of 2.5 micrometers or less; ( ) = represents negative value or a net decrease in emissions.

1 Alternative 3 construction emissions were conservatively modeled assuming all construction activities would occur with one calendar year. It possible that construction activities for Alternative 3 could require up to 2.5 years. However, it is anticipated that even if construction emissions were modeled using a 2.5-year construction schedule, emissions of NO_X and CO shown above would continue to exceed the *de minimis* thresholds, but construction-related annual emissions of VOC/ROG could potentially be below the *de minimis* threshold. Nevertheless, for a conservative analysis, all construction emissions have been assumed to occur over one year.

Table 3.3-7 Summary of Unmitigated Annual Criteria Air Pollutant and Precursor Emissions Associated with Construction Activities for Alternative 3					
Source/Year	Emissions (tons/year)				
	VOC/ROG	NO_X	CO	PM_{10}	$PM_{2.5}$

[2] The *de minimis* thresholds shown represent the most conservative *de minimis* thresholds from either SFBAAB or SJVAB.

Sources: Modeling of annual construction emissions performed by Environmental Science Associates in 2014 (see Appendix E to this SEIS); U.S. Environmental Protection Agency 2013b; data compiled by AECOM in 2014

Mitigation Measure: Implement Mitigation Measure AIR-MM-1 (Perform Routine Maintenance of Construction Equipment).

Mitigation Measure: Implement Mitigation Measure AIR-MM-2 (Choose Borrow Sites Close to Fill Locations).

Mitigation Measure: Implement Mitigation Measure AIR-MM-3 (Prohibit Unnecessary Idling of Construction Equipment Engines).

Mitigation Measure: Implement Mitigation Measure AIR-MM-4 (Coordinate with the SJVAPCD and BAAQMD to Reduce or Offset Emissions).

Mitigation Measure: Implement Mitigation Measure AIR-MM-5 (Use Electrically Powered Pumps in Lieu of Diesel Powered Pumps, If Necessary).

Mitigation Measure: Implement Mitigation Measure AIR-MM-6 (Implement Construction Practices that Reduce Generation of Particulate Matter).

Table 3.3-8 presents the construction emissions of Alternative 3 following implementation of the proposed mitigation measures along with the applicable *de minimis* thresholds. As shown in Table 3.3-8, even with implementation of the proposed mitigation measures, annual construction-related emissions of ROG, NO_X and CO under Alternative 3 would continue to exceed the applicable *de minimis* thresholds. Thus, implementation of Alternative 3 would require a full conformity analysis for its construction-related ROG, NO_X and CO emissions.

Table 3.3-8
Summary of Mitigated Annual Criteria Air Pollutant and Precursor Emissions Associated with Construction Activities for Alternative 3

Source/Year	Emissions (tons/year)				
	VOC/ROG	NO_X	CO	PM_{10}	$PM_{2.5}$
Annual Construction [1]	65.9	548.7	275.3	122.4	74.6
de minimis Threshold [2]	50	50	100	100	100
Exceeds *de minimis* Threshold?	**Yes**	**Yes**	**Yes**	No	No

Notes: VOC = volatile organic compounds; ROG = reactive organic gases; NO_X = oxides of nitrogen; CO = carbon monoxide; PM_{10} = particulate matter with an aerodynamic diameter of 10 micrometers or less; $PM_{2.5}$ = particulate matter with an aerodynamic diameter of 2.5 micrometers or less; ( ) = represents negative value or a net decrease in emissions.

[1] Alternative 3 construction emissions were conservatively modeled assuming all construction activities would occur with one calendar year. It possible that construction activities for Alternative 3 could require up to 2.5 years. However, it is anticipated that even if construction emissions were modeled using a 2.5-year construction schedule, emissions of NO_X and CO shown above would continue to exceed the *de minimis* thresholds, but construction-related annual emissions of VOC/ROG could potentially be below the *de minimis* threshold. Nevertheless, for a conservative analysis, all construction emissions have been assumed to occur over one year.

Table 3.3-8
Summary of Mitigated Annual Criteria Air Pollutant and Precursor Emissions Associated with Construction Activities for Alternative 3

Source/Year	Emissions (tons/year)				
	VOC/ROG	NO_X	CO	PM_{10}	$PM_{2.5}$

[2] The net operational emissions are the difference between the No-Action Alternative and Alternative 3 operational emissions.

[3] The *de minimis* thresholds shown represent the most conservative *de minimis* thresholds from either SFBAAB or SJVAB.

Sources: Modeling of annual construction emissions performed by Environmental Science Associates in 2014 (see Appendix E to this SEIS); U.S. Environmental Protection Agency 2013b; data compiled by AECOM in 2014

Table 3.3-9
Comparison of Delta Wetlands Project 2001 FEIS and this SEIS Effects and Mitigation Measures for Air Quality

2001 FEIS Effects and Mitigation Measures	SEIS Effects and Mitigation Measures
Alternatives 1 and 2 (Proposed Action)	
Impact O-1: Increase in CO Emissions on the DW Project Islands during Construction (LTS) **Mitigation Measure O-1:** Perform Routine Maintenance of Construction Equipment **Mitigation Measure O-2:** Choose Borrow Sites Close to Fill Locations **Mitigation Measure O-3:** Prohibit Unnecessary Idling of Construction Equipment Engines	**Effect AIR-1:** Increase in CO Emissions on the Project Islands during Construction (LTS) **Mitigation Measure AIR-MM-1:** Perform Routine Maintenance of Construction Equipment **Mitigation Measure AIR-MM-2:** Choose Borrow Sites Close to Fill Locations **Mitigation Measure AIR-MM-3:** Prohibit Unnecessary Idling of Construction Equipment Engines No change.
Impact O-2: Increse in CO Emissions on the DW Project Islands during Project Operation (LTS) **Mitigation:** No mitigation is required.	**Effect AIR-2:** Increase in CO Emissions on the Project Islands during Project Operation (LTS) **Mitigation:** No mitigation is required. No change.
Impact O-3: Increase in ROG Emissions on DW Project Islands during Construction (SU) **Mitigation Measure O-1:** Perform Routine Maintenance of Construction Equipment **Mitigation Measure O-2:** Choose Borrow Sites Close to Fill Locations **Mitigation Measure O-3:** Prohibit Unnecessary Idling of Construction Equipment Engines	**Effect AIR-3:** Increase in ROG Emissions on the Project Islands during Construction (SU) **Mitigation Measure AIR-MM-1:** Perform Routine Maintenance of Construction Equipment **Mitigation Measure AIR-MM-2:** Choose Borrow Sites Close to Fill Locations **Mitigation Measure AIR-MM-3:** Prohibit Unnecessary Idling of Construction Equipment Engines
Impact O-4: Increase in NO_X Emissions on the DW Project Islands during Construction (SU) **Mitigation Measure O-1:** Perform Routine Maintenance of Construction Equipment **Mitigation Measure O-2:** Choose Borrow Sites Close to Fill Locations **Mitigation Measure O-3:** Prohibit Unnecessary Idling of Construction Equipment Engines	**Effect AIR-5:** Increase in NO_X Emissions on the Project Islands during Construction (SU) **Mitigation Measure AIR-MM-1:** Perform Routine Maintenance of Construction Equipment **Mitigation Measure AIR-MM-2:** Choose Borrow Sites Close to Fill Locations **Mitigation Measure AIR-MM-3:** Prohibit Unnecessary Idling of Construction Equipment Engines No change.

Table 3.3-9
Comparison of Delta Wetlands Project 2001 FEIS and this SEIS Effects and Mitigation Measures for Air Quality

2001 FEIS Effects and Mitigation Measures	SEIS Effects and Mitigation Measures
Impact O-5: Increase in ROG Emissions on the DW Project Islands during Project Operation (SU) **Mitigation Measure RJ-1:** Reduce the Number of Outward Boat Slips Located at Recreational Facilities **Mitigation Measure O-4:** Coordinate with Local Air Districts to Reduce or Offset Emissions	**Effect AIR-4:** Increase in ROG Emissions on Project Islands during Operation (LTS) **Mitigation:** No mitigation is required. The effects analysis, conclusion, and mitigation measures have changed because the project no longer includes the construction of new recreation facilities.
Impact O-6: Increase in NO_X Emissions on the DW Project Islands during Project Operation (SU) **Mitigation Measure RJ-1:** Reduce the Number of Outward Boat Slips Located at Recreation Facilities **Mitigation Measure O-4:** Coordinate with Local Air Districts to Reduce or Offset Emissions	**Effect AIR-6:** Increase in NO_X Emissions on the Project Islands during Opreation (LTS-M) **Mitigation Measure AIR-MM-4:** Coordinate with the BAAQMD to Reduce or Offset Emissions **Mitigation Measure AIR-MM-5:** Use Electrically-Powered Pumps in Lieu of Diesel-Powered Pumps (If Necessary) The mitigation measures have changed because the project no longer includes the construction of recreation facilities.
Impact O-7: Increase in PM_{10} Emissions on DW Project Islands during Construction (S) **Mitigation Measure O-1:** Perform Routine Maintenance of Construction Equipment **Mitigation Measure O-2:** Choose Borrow Sites Close to Fill Locations **Mitigation Measure O-3:** Prohibit Unnecessary Idling of Construction Equipment Engines **Mitigation Measure O-5:** Implement Construction Practices That Reduce Generation of Particulate Matter	**Effect AIR-7:** Increase in PM_{10} Emissions on the Project Islands during Construction (LTS-M) **Mitigation Measure Air-MM-6:** Implement Construction Practices that Reduce Generation of Particulate Matter
Impact O-8: Decrease in PM_{10} Emissions on the DW Project Islands during Project Operation (LTS-B) **Mitigation:** No mitigation is required.	**Effect AIR-8:** Increase in PM_{10} Emissions on the Project Islands during Construction (LTS) **Mitigation:** No mitigation is required. No change.
Not previously analyzed.	**Effect AIR-9:** Need for Conformity Analysis and Conflicts with Federal Attainment Planning (S) **Mitigation Measure AIR-MM-1:** Perform Routine Maintenance of Construction Equipment **Mitigation Measure AIR-MM-2:** Choose Borrow Sites Close to Fill Locations **Mitigation Measure AIR-MM-3:** Prohibit Unnecessary Idling of Construction Equipment Engines **Mitigation Measure AIR-MM-4:** Coordinate with the SJVAPCD and BAAQMD to Reduce or Offset Emissions **Mitigation Measure AIR-MM-5:** Use Electrically-Powered Pumps in Lieu of Diesel-Powered Pumps (If Necessary) **Mitigation Measure AIR-MM-6:** Implement Construction Practices that Reduce Generation of Particulate Matter This effect is new, and mitigation measures have been added.

Table 3.3-9
Comparison of Delta Wetlands Project 2001 FEIS and this SEIS Effects and Mitigation Measures for Air Quality

2001 FEIS Effects and Mitigation Measures	SEIS Effects and Mitigation Measures
Alternative 3	
Impact O-9: Increase in CO Emissions on the DW Project Islands during Construction (LTS) **Mitigation Measure O-1:** Perform Routine Maintenance of Construction Equipment **Mitigation Measure O-2:** Choose Borrow Sites Close to Fill Locations **Mitigation Measure O-3:** Prohibit Unnecessary Idling of Construction Equipment Engines	**Effect AIR-1:** Increase in CO Emissions on the Project Islands during Construction (LTS) **Mitigation Measure AIR-MM-1:** Perform Routine Maintenance of Construction Equipment **Mitigation Measure AIR-MM-2:** Choose Borrow Sites Close to Fill Locations. **Mitigation Measure AIR-MM-3:** Prohibit Unnecessary Idling of Construction Equipment Engines No change.
Impact O-10: Increase in CO Emissions on the DW Project Islands during Project Operation (LTS) **Mitigation:** No mitigation is required.	**Effect AIR-2:** Increase in CO Emissions on the Project Islands during Project Operation (LTS) **Mitigation:** No mitigation is required. No change.
Impact O-11: Increase in ROG Emissions on the DW Project Islands during Construction (SU) **Mitigation Measure O-1:** Perform Routine Maintenance of Construction Equipment **Mitigation Measure O-2:** Choose Borrow Sites Close to Fill Locations **Mitigation Measure O-3:** Prohibit Unnecessary Idling of Construction Equipment Engines	**Effect AIR-3:** Increase in ROG Emissions on the Project Islands during Construction (SU) **Mitigation Measure AIR-MM-1:** Perform Routine Maintenance of Construction Equipment **Mitigation Measure AIR-MM-2:** Choose Borrow Sites Close to Fill Locations **Mitigation Measure AIR-MM-3:** Prohibit Unnecessary Idling of Construction Equipment Engines
Impact O-12: Increase in NO_X Emissions on the DW Project Islands during Construction (SU) **Mitigation Measure O-1:** Perform Routine Maintenance of Construction Equipment **Mitigation Measure O-2:** Choose Borrow Sites Close to Fill Locations **Mitigation Measure O-3:** Prohibit Unnecessary Idling of Construction Equipment Engines	**Effect AIR-5:** Increase in NO_X Emissions on the Project Islands during Construction (SU) **Mitigation Measure AIR-MM-1:** Perform Routine Maintenance of Construction Equipment **Mitigation Measure AIR-MM-2:** Choose Borrow Sites Close to Fill Locations **Mitigation Measure AIR-MM-3:** Prohibit Unnecessary Idling of Construction Equipment Engines No change.
Impact O-13: Increase in ROG Emissions on the DW Project Islands during Project Operation (SU) **Mitigation Measure RJ-1:** Reduce the Number of Outward Boat Slips Located at Recreational Facilities **Mitigation Measure O-4:** Coordinate with Local Air Districts to Reduce or Offset Emissions	**Effect AIR-4:** Increase in ROG Emissions on Project Islands during Operation (LTS) The effects analysis, conclusion, and mitigation measures have changed because the project no longer includes the construction of new recreation facilities.
Impact O-14: Increase in NO_X Emissions on the DW Project Islands during Project Operation (SU) **Mitigation Measure RJ-1:** Reduce the Number of Outward Boat Slips Located at Recreational Facilities **Mitigation Measure O-4:** Coordinate with Local Air Districts to Reduce or Offset Emissions	**Effect AIR-6:** Increase in NO_X Emissions on the Project Islands during Opreation (LTS-M) **Mitigation Measure AIR-MM-4:** Coordinate with the SJVAPCD and BAAQMD to Reduce or Offset Emissions **Mitigation Measure AIR-MM-5:** Use Electrically-Powered Pumps in Lieu of Diesel-Powered Pumps, If Necessary

Table 3.3-9 Comparison of Delta Wetlands Project 2001 FEIS and this SEIS Effects and Mitigation Measures for Air Quality	
2001 FEIS Effects and Mitigation Measures	SEIS Effects and Mitigation Measures
	The mitigation measures have changed because the project no longer includes the construction of new recration facilities.
Impact O-15: Increase in PM_{10} Emissions on the DW Project Islands during Construction (SU) **Mitigation Measure O-1:** Perform Routine Maintenance of Construction Equipment **Mitigation Measure O-2:** Choose Borrow Sites Close to Fill Locations **Mitigation Measure O-3:** Prohibit Unnecessary Idling of Construction Equipment Engines **Mitigation Measure O-5:** Implement Construction Practices That Reduce Generation of Particulate Matter	**Effect AIR-7:** Increaes in PM_{10} Emissions on the Project Islands during Construction (LTS-M) **Mitigation Measure AIR-MM-6:** Implement Construction Practices that Reduce Generation of Particulate Matter
Impact O-16: Decrease in PM_{10} Emissions on the DW Project Islands during Project Operation (LTS-B) **Mitigation:** No mitigation is required.	**Effect AIR-8:** Increase in PM_{10} Emissions on the Project Islands during Construction (LTS) **Mitigation:** No mitigation is required. No change.
Not previously analyzed.	**Effect AIR-9:** Need for Conformity Analysis and Conflicts with Federal Attainment Planning (S) **Mitigation Measure AIR-MM-1:** Perform Routine Maintenance of Construction Equipment **Mitigation Measure AIR-MM-2:** Choose Borrow Sites Close to Fill Locations **Mitigation Measure AIR-MM-3:** Prohibit Unnecessary Idling of Construction Equipment Engines **Mitigation Measure AIR-MM-4:** Coordinate with the SJVAPCD and BAAQMD to Reduce or Offset Emissions **Mitigation Measure AIR-MM-5:** Use Electrically-Powered Pumps in Lieu of Diesel-Powered Pumps **Mitigation Measure AIR-MM-6:** Implement Construction Practices that Reduce Generation of Particulate Matter This effect is new, and mitigation measures have been added.

Notes: Shading denotes changes in the effect, significance conclusion, or mitigation measure from the 2001 FEIS; SU = Significant and unavoidable; S = Significant; LTS = Less than significant; LTS-M = Less than significant with mitigation; B = Beneficial

Sources: ICF 2010:4.13-2 through 4.13-5 and AECOM 2014

3.3.6 Secondary and Cumulative Effects

Secondary and cumulative effects on air quality resulting from implementing the project were described in the 2001 FEIS (Chapter 3O) and 2010 DEIR (Chapter 5). The 2001 FEIS and 2010 DEIR are herein incorporated by reference, and the effects conclusions and mitigation measures, along with any changes, are summarized briefly below and shown in Table 3.3-10.

INCREASE IN CUMULATIVE PRODUCTION OF OZONE PRECURSORS AND CARBON MONOXIDE IN THE DELTA

Project-related construction and operational activities would not generate emissions of CO that exceed the regional thresholds; however, emissions of ROG NO_X would exceed the regional thresholds. Therefore, the project would result in a cumulatively considerable contribution to this cumulatively significant effect.

> Mitigation Measure: Implement Mitigation Measure AIR-MM-1 (Perform Routine Maintenance of Construction Equipment).
>
> Mitigation Measure: Implement Mitigation Measure AIR-MM-2 (Choose Borrow Sites Close to Fill Locations).
>
> Mitigation Measure: Implement Mitigation Measure AIR-MM-3 (Prohibit Unnecessary Idling of Construction Equipment Engines).
>
> Mitigation Measure: Implement Mitigation Measure AIR-MM-4 (Coordinate with the SJVAPCD and BAAQMD to Reduce or Offset Emissions).
>
> Mitigation Measure: Implement Mitigation Measure AIR-MM-5 (Use Electrically Powered Pumps in Lieu of Diesel Powered Pumps, If Necessary).

Implementing Mitigation Measures AIR-MM-1 through AIR-MM-5 would reduce this effect to a less-than-significant level for the project's operational activities. However, these effects would not be reduced to a less-than-significant level for construction activities because the project's construction emissions would still exceed regional significance thresholds. No other feasible mitigation measures are available to fully reduce adverse effects. Thus, the cumulative effect of the project's construction-related ROG and NO_X emissions would be significant and unavoidable. Because the project's construction emissions would be significant on a project-level and subsequently could affect attainment of ambient air quality standards, the project's cumulative construction effects are cumulatively considerable and unavoidable.

Table 3.3-10
Comparison of Secondary and Cumulative Air Quality Effects between the 2001 FEIS and this SEIS

2001 FEIS Cumulative Effects and Mitigation Measures	SEIS Cumulative Effects and Mitigation Measures
Impact O-16: Increase in Cumulative Production of Ozone Precursors and CO in the Delta (CCU) **Mitigation Measure RJ-1:** Reduce the Number of Outward Boat Slips Located at the Proposed Recreation Facilities **Mitigation Measure O-4:** Coordinate with Local Air Districts to Reduce or Offset Emissions	Increase in Cumulative Production of Ozone Precursors and Carbon Monoxide in the Delta (CCU) **Mitigation Measure AIR-MM-1**: Perform Routine Maintenance of Construction Equipment **Mitigation Measure AIR-MM-2:** Choose Borrow Sites Close to Fill Locations **Mitigation Measure AIR-MM-3:** Prohibit Unnecessary Idling of Construction Equipment Engines **Mitigation Measure AIR-MM-4:** Coordinate with the SJVPACD and BAAQMD to Reduce or Offset Emissions **Mitigation Measure AIR-MM-5:** Use Electrically Powered Pumps in Lieu of Diesel Powered Pumps, If Necessary The effects analysis and mitigation measures have changed because the project no longer includes the construction of new recreation facilities.

Notes: Shading denotes changes in the effect, significance conclusion, or mitigation measure from the 2001 FEIS; CCU = Cumulatively considerable and unavoidable

Sources: ICF 2010:5-36 and AECOM 2014

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3.4 AQUATIC RESOURCES

3.4.1 INTRODUCTION

This section describes recent changes to the existing environmental conditions and regulatory setting of the project area, summarizes the affected environment, and describes changed environmental effects related to aquatic resources, including wetlands, for the project. This section contains a review and update of the 1995 DEIR/EIS aquatic resources effects assessment, which was incorporated by reference in the 2001 FEIS (Chapters 3F and 3G). The aquatic resources effects of the project were analyzed most recently in Section 4.5, "Fisheries Resources," Section 4.6, "Vegetation and Wetlands," and Chapter 5, "Cumulative Impacts," of the 2010 DEIR, which also served as a basis for this analysis and are herein incorporated by reference.

The 2001 FEIS concluded that the project alternatives would affect aquatic resources on and in the vicinity of the four project islands. Since that time, there have been changes in the "Affected Environment" and the "Regulatory Framework/Applicable Laws, Regulations, Plan, and Policies." However, there have been no changes in the project that result in new significant adverse environmental effects or a substantial increase in the severity or intensity of previously identified significant adverse effects on aquatic resources, including wetlands.

This aquatic resources analysis, including wetlands, has been updated by information provided by Environmental Science Associates to reflect the environmental conditions on and around the project islands. In particular, the Draft Compensatory Mitigation Plan (CMP) included in the 2001 FEIS was supplemented with a Draft Mitigation Plan and Conceptual Restoration Plans (Environmental Science Associates 2015, attached as Appendix B). These plans update the amount and types of habitat creation that would occur on the Habitat Islands under Alternatives 1 and 2. Implementation of these plans under Alternatives 1 or 2 would result in a net increase in freshwater marsh, cottonwood-willow, Great Valley willow scrub, and permanent pond habitats on the Habitat Islands. This analysis has also been updated to reflect the data contained in the project's revised wetland delineation, which was verified by the U.S. Army Corps of Engineers (USACE) in 2012.

This analysis also incorporates information provided in the U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) biological opinions (BOs) prepared in 1997 in response to prior project review and permitting.

Consistent with the 2001 FEIS, the effects analysis presented in this section is limited to wetlands and other waters of the U.S. under the jurisdiction of USACE; fish species that support important sport and commercial fisheries; species that are unique to the Bay-Delta environment; species listed or being considered for listing under the Federal Endangered Species Act (ESA) and the California Endangered Species Act (CESA); and species that, when considered as a group, encompass the range of potential responses to the effects of project operations and facility construction. The species specifically addressed in this assessment are Chinook salmon (*Oncorhynchus tshawytscha*), steelhead (*O. mykiss*), delta smelt (*Hypomesus transpacificus*), longfin smelt (*Spirinchus thaleichthys*), and green sturgeon (*Acipenser medirostris*). Sacramento splittail (*Pogonichthys macrolepidotus*) was considered in the previous studies that have been prepared for this project. However, since Sacramento splittail has been delisted since the 2001 FEIS, it has been removed from the environmental analysis for this SEIS.

On-island fisheries resources (i.e., fish within the existing water bodies on the project islands) were not included in the fisheries effects assessment because no fish species occur that meet the above criteria.

The project would not have any direct effects on aquatic resources, including wetlands, in the places of use; the effects on aquatic resources, including wetlands, if any, associated with the provision of project water to the places of use are addressed in the "Secondary and Cumulative Effects" subsection below and in Chapter 4, "Other Statutory Requirements."

SUMMARY OF CHANGES, NEW CIRCUMSTANCES, AND NEW INFORMATION

Substantial Changes in the Project

Since the 2001 FEIS was completed, there have been no substantial changes in the project resulting in new significant effects or substantial increase in the severity or intensity of effects on aquatic resources, including wetlands.

The proposed operations of the project have changed such that diversions would not occur in April and May, and the diversion and discharge periods would be informed by monitoring and adaptively managed to be more protective of fisheries resources consistent with new circumstances and new information. Many of the fish protection measures agreed to in the previous (1997) final operations criteria (FOC) apply to project operations for purposes of this analysis. The project would obtain revised BOs from USFWS and NMFS, and a revised incidental take permit (ITP) from the California Department of Fish and Wildlife (DFW); revised biological assessments (BAs) and an ITP application have been submitted to these agencies for review. Four of the provisions in the 1997 FOC are now included as environmental commitments, including monitoring and assessment of water quality and detailed operating parameters for diversion and discharge.

Additionally, the project no longer includes a proposal to construct new recreation facilities on the Reservoir or Habitat Islands; this change to the project results in a reduction and/or elimination of some the previously identified environmental effects.

New Circumstances and New Information

Fisheries Resources

Changes to the affected environment and regulatory setting have occurred since 2001 and are herein incorporated by reference in the current analysis of fisheries resources:

- the measured decrease in the abundance of four San Francisco estuary fish species (delta smelt, longfin smelt, striped bass, and threadfin shad) known as the pelagic organism decline (POD);

- fluctuating abundance of salmonids, with fall-run Chinook salmon generally decreasing and other runs such as winter- and late fall–run Chinook salmon showing some increases coupled with variability, but with all runs being low in abundance in 2007 and 2008 primarily because of poor ocean conditions (Lindley et al. 2009);

- the revised BOs for the Operations Criteria and Plan (OCAP) requiring U.S. Bureau of Reclamation (Reclamation) and California Department of Water Resources (DWR) to manage the Central Valley Project (CVP) and State Water Project (SWP) Sacramento-San Joaquin Delta (Delta) operations to protect:

  - delta smelt (2008 U.S. Fish and Wildlife Service Operations Criteria and Plan Biological Opinion; U.S. Fish and Wildlife Service 2008);

  - winter-run Chinook salmon, Central Valley spring-run Chinook salmon, Central Valley steelhead, the southern distinct population segment (DPS) of North American green sturgeon, and southern resident killer whales (2009 NMFS OCAP BO National Marine Fisheries Service Operations Criteria and Plan Biological Opinion; National Marine Fisheries Service 2009); and

- the longfin smelt ITP for SWP Delta Facilities and Operations (2009 California Department of Fish and Wildlife State Water Program Incidental Take Permit; California Department of Fish and Wildlife 2009a).

The implications of these changes are reflected in the updates of fisheries resource effects.

Wetlands

In November 2012, an updated wetland delineation was verified by USACE for the project (Environmental Science Associates 2012). The verified delineation was used as the baseline for the present evaluation of wetland effects. The 2012 delineation represents changes in acreages for many of the previously delineated wetland types. It also includes a new wetland classification type not previously used in the 2001 FEIS: farmed wetlands. It should be noted that the soil and crop characteristics of land now classified as farmed wetlands were present on the islands when the previous delineation was performed; however, these areas were not classified as jurisdictional wetlands at that time. As a result, this change in classification reflects a change in the regulatory environment, or the way these areas are regulated, rather than a change in the physical environment. For the purposes of the 2012 wetland delineation and this SEIS analysis, farmed wetlands are defined as areas that are actively farmed and exhibit surface ponding or saturated soils for at least 15 days each year. With the inclusion of this wetland type, and an approximate 384-acre net increase in the acreage of freshwater marsh (due in part to reclassification of exotic marsh to freshwater marsh) and other habitat types, the overall area of jurisdictional wetlands on the project islands (and therefore project effects to these features) has increased compared to the prior analysis. This increase in effects in turn has led to a corresponding increase in the amount of compensatory mitigation that would be needed. Despite this increase in the magnitude of effects and mitigation, these changes do not substantially alter the conclusions of the evaluation of project effects to jurisdictional wetlands and waters of the U.S. from those of the 2001 FEIS.

SUMMARY OF ENVIRONMENTAL COMMITMENTS

Environmental commitments are measures incorporated by the project applicant as part of the project, meaning they are elements of the Proposed Action and are therefore considered in conducting the environmental analysis for each resource area of this SEIS. The purpose of environmental commitments is to reflect and incorporate best practices into the project that avoid, minimize, reduce, or offset potential adverse environmental effects. A complete description of the environmental commitments that have been incorporated into the project since the 2001 FEIS is contained in Chapter 2, “Project Description and Alternatives” of this SEIS. The environmental commitments relevant to aquatic resources and wetlands are discussed below.

Fisheries Resources

A number of environmental commitments were presented in the 2001 FEIS to avoid, reduce, and mitigate potential effects of the project based upon the FOC of January 27, 1997. The FOC included various measures related to diversion, discharge, and other aspects of the project that have the potential to affect fisheries resources and are detailed in Appendix B of the 2000 REIR/EIS. Where appropriate and relevant, previous environmental commitments have been carried forward and are included and updated in this analysis as described below.

Screened Diversions

The proposed diversion siphons would be screened for fish protection. The fish screens would be designed and operated to meet USFWS criteria for delta smelt (0.2-feet/second [ft/sec] approach velocity) and would incorporate a drum design to minimize the length of exposure, drawing water from all directions. The positive barrier fish screens would be constructed using a cylindrical wedge-wire design with a maximum screen mesh opening of 1.75 millimeters (mm) and a maximum design approach velocity of 0.2 ft/sec. The intake screens have a capability of being set for 5-minute cleaning intervals if necessary, but would be cleaned in accordance with current USFWS/NMFS/DFW criteria whenever the diversion is in operation. The fish screens would be inspected at least annually for screen mesh integrity and routine maintenance. As a result of the tidal hydrodynamics near the project islands, fish screen sweeping velocities would be bi-directional and would vary based on tidal and local hydrodynamic conditions.

Fish Monitoring and Habitat Protection

Previous evaluations of project effects to fish, the project BOs, and the DFW ITP have described monitoring and operational criteria for fish protection. These are generally described together here as an environmental commitment. To summarize, during January through March, this commitment requires the project applicant to obtain most recent information from DFW trawls. Presence of larval smelt in the vicinity of the Reservoir Islands (trawl stations 809, 812, 815, 901, 902, 914, 915, and 918) would trigger daily monitoring to be conducted by the project applicant during the diversion season at the Reservoir Island diversions. If smelt are found in monitoring results, project diversions would be reduced. During July, this commitment requires the project applicant to obtain most recent information in fish salvage at the SWP and CVP fish facilities. If juvenile longfin or delta smelt are present in salvage collections, the project's discharge for export rate would immediately be reduced. Additionally, the project applicant would establish a Monitoring Technical Advisory Committee (MTAC) to advise and resolve monitoring issues that may develop over the life of the project. This environmental commitment also includes additional operation criteria for Webb Tract diversions that were agreed upon with the East Bay Municipal Utility District (EBMUD). (The stipulated agreement between the project applicant and EBMUD includes several measures to reduce potential project effects on migrating Mokelumne River fish.)

The project applicant has agreed to provide a conservation easement on approximately 200 acres of brackish tidal wetlands on the western tip of Chipps Island to compensate for a potential shift in X2 (per a prior agreement with DFW). The project applicant is also proposing to conserve in perpetuity an additional 40 acres of brackish tidal wetlands on Chipps Island to compensate for adverse effects related to the loss of shallow water habitat that would result in the construction of docks and pumps at the Reservoir Islands. Therefore, the project applicant is proposing to conserve in perpetuity approximately 240 acre of brackish tidal wetlands on Chipps Island. A management plan for the easement area will be developed by the project within the first year of project operation for the habitat covered by the easement, and will be incorporated as an exhibit to the easement.

Additionally, the project applicant will provide documentation to USFWS demonstrating that there is adequate financing for the perpetual management of the habitat protected by the conservation easement consistent with the management plan including that (1) adequate funds for the management of habitat in perpetuity protected by the conservation easement have been transferred to an appropriate third party, (2) the third party has accepted the funds, and (3) such funds have been deposited in an interest-bearing account intended for the sole purpose of carrying out the purpose of this easement.

The easement (along with a title report for the easement area) and management plan will be approved by the USFWS prior to recordation. After approval, the easement and management plan will be recorded in the appropriate County Recorder's office(s). A copy of the recorded easement will be provided to USFWS within 30 days after recordation.

Water Quality Measurements

To ensure that key water quality parameters that are important to fish species habitat are monitored and controlled, the project would implement monitoring and assessment programs designed specifically to regulate water temperature and dissolved oxygen (DO) levels. These programs would follow detailed guidelines regarding water release to adjacent channels to minimize, reduce, or avoid adverse effects of project discharges to channel water temperature and DO levels. Additionally, monitoring and implementation plans would be developed for both parameters and would be completed after the project is permitted, but at least 90 days prior to project operations. The plans would be submitted to the responsible agencies for approval with the concurrence of the resource agencies.

Implementation of Temperature Standards

This environmental commitment is the same as the 1997 FOC except that the temperature measurements are specified to be weekly averages to account for daily variations in temperature. The project would develop temperature monitoring and implementation plans to ensure that the project does not adversely affect the channel temperature levels as described below. The monitoring plan would include reservoir and channel temperature monitoring. The monitoring and implementation plan would be completed after the project is permitted, but at least 90 days prior to project operations. The plans would be submitted to the responsible agencies for approval with the concurrence of the resource agencies.

- The project would not discharge reservoir water for export if the weekly average temperature differential between the discharge and the adjacent channel temperature is greater than or equal to 20°Farenheit (F).
- If the natural receiving water temperature of the adjacent channel is greater than or equal to a weekly average of 55°F and less than 66°F, project discharges would not increase the channel temperature by more than a weekly average of 4°F.
- If the natural receiving water temperature of the adjacent channel is greater than or equal to a weekly average of 66°F and less than 77°F, project discharges for export would not cause an increase of more than a weekly average of 2°F.
- If the natural receiving water temperature of the adjacent channel is greater than or equal to a weekly average of 77°F, project discharges for export would not cause an increase of more than a weekly average of 1°F.

Implementation of Dissolved Oxygen Standards

This environmental commitment is identical to the FOC. The project would develop DO monitoring and implementation plans to ensure that the project does not adversely affect the channel DO levels as described below. The monitoring plan would include reservoir and channel DO monitoring. The monitoring and implementation plans would be completed after the project is permitted, but at least 90 days prior to project operations. The plans would be submitted to the responsible agencies for approval with the concurrence of the resource agencies.

- The project would not discharge reservoir water for export if the discharge DO level is less than 6.0 milligrams per liter (mg/l) without authorization from the resource agencies and notice to the responsible agencies.
- The project would not discharge reservoir water for export if the discharge would cause channel water DO levels to fall below 5.0 mg/l.

Diversion and Discharge Reduction

This environmental commitment involves the monitoring of water diverted onto the Reservoir Islands and would require diversions to be reduced/curtailed if larval delta or longfin smelt are found in the diverted water. This commitment was established to reduce the project effects to fish species present in the central Delta and minimize the rate of potential entrainment onto the project islands during diversions made from December to March.
The seasonal and geographic distribution of larval longfin and delta smelt varies substantially within and among years in response to a variety of factors such as the location of spawning, seasonal water temperatures, and Delta hydrologic conditions (e.g., river flows, Delta inflow, and Delta outflow). Results of fisheries studies conducted by DFW (e.g., larval smelt, 20-mm survey, and spring Kodiak trawl) provide valuable information that can be used to assess the seasonal and geographic distribution of both longfin and delta smelt and their potential risk of entrainment resulting from Reservoir Island operations. This commitment is similar to a measure identified in the USFWS OCAP BO (U.S. Fish and Wildlife Service 2008) that establishes criteria to estimate the time period that delta smelt larvae would be present within different areas of the Delta based on catch data at sampling stations. The commitment requires monitoring for presence of larval delta smelt at selected DFW sampling stations as a trigger for the purposes of managing diversion operations. This management approach is discussed in further detail below.

Implementation of Diversion and Discharge Reductions during Smelt Presence−Diversions: From January through March, the project would obtain the most recent information on larval and early-juvenile longfin and delta smelt distribution from the DFW larval smelt and 20-mm surveys. The larval smelt survey (initiated in January 2009) begins in the second week of January and runs every second week until the second week in March. The 20-mm survey begins in mid-March and samples a variety of sites fortnightly until mid-July. Presence of larval smelt in the vicinity of the Reservoir Islands would trigger monitoring of project diversion sites for evidence of larval smelt. Monitoring would be required only for the Reservoir Island(s) near which larval smelt have been collected. The triggers for monitoring of diversion sites would be:

- Webb Tract: presence of at least one larval smelt at survey stations 809, 812, 815, or 901; and
- Bacon Island: presence of at least one larval smelt at survey stations 902, 914, 915, or 918.

Diversion sites would be monitored daily during diversion periods. Should larval smelt be detected, the diversion rate would be immediately reduced by 50%. Smelt presence is defined as a 2-day running average in excess of one delta or longfin smelt per day at the sampled reservoir diversion station. If the 2-day running average of smelt presence is below one smelt per day, diversions would be increased by 10% per day to 100% after 5 days. Daily monitoring would continue until the subsequent larval smelt survey's data are available. If these data indicate that larval smelt are no longer present in the vicinity of the Reservoir Island(s) then diversion monitoring would cease. Monitoring would recommence if subsequent DFW smelt larval surveys once again reveal smelt presence at the stations noted above. Monitoring would not be required at a diversion station if the total diversion rate at the station is less than 50 cubic feet per second (cfs) (e.g., during topping-off). Weekly monitoring reports would be transmitted by fax and daily reports by email to the fisheries agencies as follows:

- USFWS, Sacramento Fish and Wildlife Office
- NMFS, Protected Resources and Habitat Conservation Division
- DFW, Habitat Conservation Division (Central Valley–Bay Delta Branch)

Monitoring samples (preserved fish) would be retained for a minimum of 1 year after collection. Agency biologists and law enforcement personnel would have 24-hour access to fish monitoring personnel, fish samples, and daily fish capture data. A Quality Assurance/Quality Control (QA/QC) protocol, acceptable to the fisheries agencies, would be developed and provided to the fisheries agencies as part of the final monitoring program plan. The QA/QC protocol would include, but is not limited to, measures to ensure correct identification of larval and juvenile fishes.

Implementation of Diversion and Discharge Reductions during Smelt Presence−Discharges: During July, the project would obtain the most recent information on fish salvage at the SWP and CVP fish facilities. If juvenile longfin or delta smelt are present in salvage collections, the discharge for export rate would immediately be reduced by 50%. Smelt presence is defined as a 2-day running average in excess of one delta or longfin smelt per day at either fish salvage facility. Discharges would be increased to 100% if monitoring data indicate that the 2-day running average of smelt presence is below one smelt per day.

The project would establish a Monitoring Technical Advisory Committee (MTAC) to advise and resolve monitoring issues that may develop over the life of the project. The MTAC would be made up of the project applicant and voluntary participants from a variety of agencies, including, but not limited to, invitees from the State Water Resources Control Board (SWRCB), USACE, USFWS, NMFS, DFW, DWR, Reclamation, and the U.S. Environmental Protection Agency (EPA). The project applicant may convene the MTAC to evaluate and recommend adjustments to the monitoring program. Initially, the project applicant would work directly with DFW to resolve daily technical monitoring issues but may convene the MTAC to act in a technical capacity to provide review and address any technical inadequacies or disagreements that may occur. The committee also may provide advisory review on issues of waiver occurring during implementation of the monitoring program. Any modifications to the monitoring program must be made with the approval of the responsible agencies and concurrence of the resource agencies who would continue to retain final approval or disapproval of any monitoring changes.

The 240-acre conservation easement on Chipps Island (described above) would also mitigate for potential losses of larval/early-juvenile smelt, salmonid, and sturgeon rearing habitat.

Water Quality Management Plan

The water quality management plan (WQMP) was developed as part of the protest dismissal agreement between the project and the California Urban Water Agencies (CUWA) during the project's water right hearing in 2000 and was amended in 2013 to include taste and odor concerns raised by the urban water utilities that are diverting water from the Delta. The WQMP also was included as a condition of the protest dismissal agreement with Contra Costa Water District (CCWD). The CCWD agreement includes operational restrictions to reduce the effects of the project on CCWD's diversions and Los Vaqueros Reservoir salinity management and fish protection operations. A copy of the 2013 WQMP is presented in Appendix C.

The major provisions of the WQMP address salinity and DOC concentrations at Delta export facilities. The WQMP requires the establishment of a water quality management board to review, approve, and implement the annual water quality operating plan. The operating plan would establish maximum Reservoir Island concentrations for salinity (total dissolved solids [TDS]), chloride, bromide, and total organic carbon (TOC). Measures to control effects on exports and diversions would be established and implemented when project storage concentrations approach these maximum allowable concentrations. These measures generally involve adjusting discharges for export or releasing storage water during periods of high outflow to minimize potential effects on exports related to Delta and municipal water quality.

A monitoring program would be established to support and implement the WQMP for the project. Available California Data Exchange Center (CDEC) data would be incorporated into the water quality monitoring and reporting program to implement the water quality control measures. Hydrodynamic and water-tracking modeling would be used to estimate the effects of project discharges on water quality at CVP, SWP, CCWD, and other urban intakes.

The 2013 WQMP includes provisions to minimize taste and odor impacts at water treatment plants that are caused or contributed to by discharges from the Reservoir Islands. The 2013 WQMP contains measures to ensure that project operations would not cause an increase in total nitrogen or total phosphorus, cause 2-methylisoborneol (MIB) and geosmin concentrations to exceed 8 nanograms per liter (ng/L), or cause algal toxins to reach problematic levels at one or more of the urban intakes. Also, as a general operating principle, the 2013 WQMP requires the project to manage algal growth on the Reservoir Islands to minimize the production of algal toxins, taste- and odor-producing algae, filter-clogging algae, and/or toxin-producing algae.

Stormwater Pollution Prevention Plan, Best Management Practices, and Dewatering Permits

Construction activities have the potential to introduce contaminants into nearby water bodies. The project applicant would implement best management practices (BMPs) to minimize water pollution associated with construction, as described below. (BMPs would be specified in permits required for construction activities.)

Erosion

To obtain coverage under the National Pollutant Discharge Elimination System (NPDES) General Construction Permit, a stormwater pollution prevention plan (SWPPP) is required. Site-specific erosion control measures would be developed as part of the SWPPP. BMPs that would be contained in the SWPPP consist of, but are not limited to, the following:

Timing of construction. Conduct earthwork during dry months.

Staging of construction equipment and materials. Stage construction equipment and materials on the landside of construction areas. To the extent possible, stage equipment and materials in areas that already have been disturbed.

Soil and vegetation disturbance. Minimize ground and vegetation disturbance during construction by establishing designated equipment staging areas, ingress and egress corridors, spoils disposal and soil stockpile areas, and equipment exclusion zones prior to the commencement of construction.

Grading spoils. Stockpile soil and grading spoils on the land side of the subject levee reaches, and install sediment barriers (e.g., silt fences, fiber rolls, straw bales) around the base of stockpiles to intercept runoff and sediment during storm events. If necessary, cover stockpiles with geotextile fabric to provide protection against wind and water erosion.

Sediment barriers. Install sediment barriers on graded or otherwise-disturbed slopes as needed to prevent sediment from leaving the project site and entering nearby surface waters.

Site stabilization. Install native plant materials to stabilize cut and fill slopes and other disturbed areas once construction is complete. Plant materials may include an erosion control seed mixture or shrub and tree container stock. Temporary structural BMPs, such as sediment barriers, erosion control blankets, mulch, and a mulch tackifier, may be installed as needed to stabilize disturbed areas until vegetation becomes established.

Pollutants

Other BMPs may be established to minimize the potential for and effects from spills of harmful substances during construction and operation activities. These may include practices such as double-walled tanks, containment berms, emergency shut-offs, drip pans, fueling procedures, and spill response kits, as well as ensuring training in proper handling procedures and spill prevention and response procedures.

Additional Commitments to Protect Salmonids

Measures included in the Protest Dismissal Agreement between the project applicant and EBMUD will also be implemented as part of the project to minimize potential effects to salmonids. As per the agreement, a Webb Tract Fisheries Monitoring Program will be established and will include the following elements (described in detail within the protest dismissal agreement dated September 13, 2000):

- During January, February, and March, the project applicant will provide a monthly operations plan to EBMUD showing when diversions to Webb Tract and Bouldin Island are anticipated to take place.

- EBMUD will be notified prior to commencing diversions to Webb Tract or Bouldin Island that exceed 50 cfs.

- A fee will be paid to EBMUD for monitoring expenses during years when the northeastern Webb Tract diversion station is operated during confirmed presence of out-migrating Mokelumne River juvenile salmonids.

- Activities will be implemented to determine presence of Mokelumne River juvenile salmonids by monitoring the northeastern diversion structure fish screens and performing a predator stomach content analysis for juvenile salmonids.

- If the presence of Mokelumne River juvenile salmonids is confirmed, the project applicant will immediately reduce its diversions at the northeastern Webb Tract diversion station by 50% of the operating rate, or to an instantaneous diversion rate of 50 cfs, whichever is greater.

Wetland Resources

The environmental commitments related to wetland resources originated in a Draft Habitat Management Plan originally developed in 1995 by ICF. Current commitments are detailed in the Draft Compensatory Mitigation Plan (CMP) more recently prepared for the project in 2013 (Environmental Science Associates 2015) (Appendix B). Environmental commitments related to the long-term management of wetlands are based on actions described in the CMP. Once permitting for the project is completed, a Final CMP that will incorporate final permit conditions from USACE, USFWS, NMFS, and DFW will be completed.

As part of the project's environmental commitments, compensation for the loss of riparian and pond habitats on the Reservoir Islands will be provided by preserving and creating cottonwood-willow habitat, riparian scrub habitat, and permanent pond habitat on the Habitat Islands. Created cottonwood-willow habitat is anticipated to be greater than 3:1 (created:existing), created willow scrub would exceed 2:1, and permanent pond habitat would be created at greater than 2:1. The post-project acreage of cottonwood-willow habitat would be 279 acres greater than existing habitat, willow scrub would increase by 137 acres, and total acreage of permanent ponds would increase by 102 acres when compared with existing conditions. The current extent of project effects to wetlands along with the expected acreages of created and preserved wetlands are presented in Table 3.4-1 and are discussed in detail in the Draft CMP developed for the project (Appendix B).

The Draft Conceptual Restoration Plans for Holland Tract and Bouldin Island (Exhibits 1 and 2 of the CMP, Appendix B) show the proposed location and extent of habitats that would be created on the Habitat Islands to compensate for habitat effects on the Reservoir Islands under Alternatives 1 or 2. These plans propose to convert existing agricultural lands to other habitat types to achieve the required compensatory mitigation goals. In almost all instances, more habitat would be created than would be lost. The one exception is the "farmed wetland" type, which would see a net decrease of approximately 656.9 acres at the expense of creating other wetland types with relatively higher levels of functions and services. Under these Conceptual Restoration Plans, there would be a total net increase of approximately 1,038.2 acres of wetlands. Thus, the net loss in farmed wetlands would occur alongside an overall net increase in wetlands and other waters of the U.S. After implementation of the project, the net increase of wetlands would consist of 747.1 acres of freshwater marsh, 279.0 acres of cottonwood-willow, 136.9 acres of Great Valley willow scrub, and 532.9 acres of seasonal wetlands. All of these wetland types provide greater functions and services than farmed wetlands.

In addition to effects to jurisdictional features on the interior of the Reservoir Islands, a loss of tidal marsh (0.9 acre) and tidal channel habitat (6.4 acres) would occur exterior to the levees on the Reservoir Islands as a result of constructing the intake facilities and associated structures. Compensation for project effects to tidal marsh and tidal channel habitat would occur in conjunction with proposed mitigation for effects to fish species by permanently preserving 40 acres of shallow-water vegetated habitat at Chipps Island. This acreage is in addition to the 200 acres that would be preserved on Chipps Island to compensate for a potential shift in X2 (as discussed previously).

3.4.2 AFFECTED ENVIRONMENT

Terminology

The following are definitions of several terms used in this SEIS:

- **X2.** The location in the Bay-Delta estuary relative to the Golden Gate Bridge (measured in kilometers) of the 2-parts per thousand (ppt) isohaline 1 meter off the bottom (San Francisco Estuary Project 1993). An isohaline is a line connecting all points of equal salinity. X2 is a function of Delta outflow volume; as outflow increases, X2 is reduced (i.e. the 2-ppt isohaline moves downstream closer to the Golden Gate Bridge). This represents the upstream end of the entrapment zone and the transition from fresh water to the estuarine salt gradient.

- **Fall midwater trawl index (FMWT).** This annual index is the sum of the weighted catch of four monthly samples (September–December) from numerous locations in the Delta and Suisun Bay. The index is assumed to be a measure of abundance when considered in relation to the catch for all other years of the sampling record (1967–2008). In the Bay-Delta estuary, the index has been developed for striped bass, American shad, delta smelt, longfin smelt, and other species.

- **Entrainment.** The process in which fish are drawn into water diversion facilities along with water drawn from a channel or other water body by siphons and/or pumps. Entrainment loss includes all fish not salvaged (i.e., eggs, larvae, juveniles, and adults that pass through the fish screens, are impinged on the fish screens, or are eaten by predators).

- **Salvage.** Removal of fish from screens on diversion structures and the subsequent return of the fish to the water body. Fish eggs and larvae (e.g., delta smelt, striped bass, and longfin smelt) are small, pass through the screens, and are not included in salvage numbers. (The SWP and CVP fish collection facilities use louvers rather than wire screens to separate fish from the water being pumped for export.)

REGIONAL SETTING

The Delta is located at the confluence of the Sacramento and San Joaquin Rivers and may be considered to represent the most important, complex, and controversial geographic area for both anadromous and resident fisheries production, wetlands, and distribution of California water resources for numerous beneficial uses. The Delta's channels are used to transport water from upstream reservoirs to the south Delta, where Federal and state facilities (i.e., Jones Pumping Plant and Harvey O. Banks Delta Pumping Plant, respectively) pump water into CVP and SWP canals, respectively.

Environmental conditions in the Delta depend primarily on the physical structure of Delta channels, inflow volume and source, Delta Cross Channel (DCC) operations, Delta exports and diversions, and tides. The CVP affects Delta conditions primarily through control of upstream storage and diversions, Delta exports and diversions, and DCC operations. These factors also determine outflow and the location of the entrapment zone, which is an area of high organic carbon that is critically important to a number of fish and invertebrate species, as well as to the overall ecology of the Delta and Suisun Bay. In addition to these physical factors, environmental conditions such as water temperature, predation, food production and availability, competition with introduced exotic fish and invertebrate species, and pollutant concentrations all contribute to interactive, cumulative conditions that have substantial effects on Delta aquatic habitats and fish populations.

The Bay-Delta supports a diverse population of native and nonnative fish species. Sampling for fish populations has been conducted throughout the Delta, including at sampling locations in the vicinity of the project islands. Results of fish sampling within the Bay-Delta estuary have shown that 55 fish species inhabit the estuary (Baxter et al.1999), about half of which are nonnative introduced species.

The Delta serves as a migration path for all Central Valley anadromous species returning to their natal rivers to spawn. Adult Chinook salmon move through the Delta during most months of the year. Salmon and steelhead juveniles depend on the Delta as transient rearing habitat during migration through the system to the ocean and could remain for several months, feeding in marshes, tidal flats, and sloughs. Delta smelt is a key species driving many of the ongoing water management decisions in the Delta. In addition, Delta outflow influences abundance and distribution of fish and invertebrates in the San Francisco Bay through changes to salinity, currents, nutrient levels, and pollutant concentrations.

Table 3.4-1
Created, Preserved, and Post-Project Acreage of Wetlands and Other Waters of the U.S.

			Created Habitat Acreage				Preserved Habitat Acreage				Post Project Habitat Acreage[1]					
			Habitat Islands				Habitat Islands				Reservoir Islands		Habitat Islands			
Habitat Type	Total Existing Habitat	Total Affected Habitat	Bouldin Island	Holland Tract	Total Habitat Created	Creation Ratio	Bouldin Island	Holland Tract	Total Habitat Preserved	Preser-vation Ratio	Bacon Island	Webb Tract	Bouldin Island	Holland Tract	Total All Islands	Δ Post-Project vs. Existing Acreage
Farmed Wetlands	2,616.5	2,195.4	1,464.6	0	1,464.6	0.67:1	423.1	0	423.1	0.19:1	0	0	1,959.6	0	1,959.6	-656.9
Freshwater Marsh	587.1	287.5	0	1,032.8	1,032.8	3.59:1	137.4	164.1	301.5	1.05:1	0	0	137.4	1,196.9	1,334.3	747.1
Seasonal Wetlands	0	0	0	532.9	532.9	N/A	0	0	0	N/A	0	0	0	532.9	532.9	532.9
Cottonwood-Willow	212.6	121.0	400.0	0	400.0	3.31:1	2.2	89.4	91.6	0.76:1	0	0	402.2	89.4	491.6	279.0
Great Valley Willow Scrub	130.7	102.1	239.0	0	239.0	2.34:1	10.5	18.1	28.6	0.28:1	0	0	249.5	18.1	267.6	136.9
Tidal Marsh[2]	0.9	0.9	0	0	0.0	0.00	0	0	0	0.00	0	0	0	0	0	-0.9
Wetlands Total	**3,547.8**	**2,706.9**	**2,103.6**	**1,565.7**	**3,669.3**	**1.36:1**	**573.2**	**271.6**	**844.8**	**0.31:1**	**0**	**0**	**2,748.7**	**1,837.3**	**4,586.0**	**1,038.2**
Canals/Ditches	124.8	65.0	0	65.0	65.0	1.01:1	41.5	18.3	59.8	0.93:1	0	0	41.5	83.3	125.3	0.0
Permanent Ponds	159.5	83.5	116	70.4	185.9	2.23:1	1.0	75.0	76.0	0.83:1	0	0	116.6	145.4	262.0	102.4
Tidal Channel[2]	6.4	6.4	0	0	0	0.00	0	0	0	0.00	0	0	0	0	0	-6.4
Seasonal Open Water	0	0	0	0	0	N/A	0	0	0	N/A	5,442.53	5,354.9	0.0	0.0	1,0797.5	10,797.5
Other Waters Total	**290.7**	**154.9**	**116**	**135.4**	**250.9**	**1.62:1**	**42.5**	**93.3**	**135.8**	**0.84:1**	**5,442.5**	**5,354.9**	**158.1**	**228.7**	**1,1184.2**	**10,893.5**
Total Wetlands and Other Waters	**3,838.5**	**2,861.8**	**2,219.2**	**1,701.1**	**3,920.3**	**1.37:1**	**615.7**	**364.9**	**980.6**	**0.34:1**	**5,442.5**	**5,354.9**	**2,906.7**	**2,066.0**	**1,5770.2**	**11,931.7**

Notes: N/A = not applicable

[1] Post-project habitat acreage is a sum of the created and preserved habitat for all habitat types except farmed wetlands. The post-project acreage of farmed wetlands also accounts for habitat conversion of 46 acres and 645.2 acres of farmed wetland on Bouldin Island and Holland Tract, respectively.

[2] Effects to tidal marsh and tidal channel habitat types would be compensated through the preservation of 40 acres of shallow-water freshwater marsh habitat at Chipps Island. This acreage is in addition to 200 acres that would be preserved on Chipps Island to compensate for a potential shift in X2.

Source: Environmental Science Associates 2013

Many of the nonnative species, such as striped bass (*Morone saxatilis*) and American shad (*Alosa sapidissima*), were purposefully introduced to provide recreational and commercial fishing opportunities. Other nonnative fish species, such as threadfin shad (*Dorosoma petenense*) and inland silversides (*Menidia beryllina*), were accidentally introduced into the estuary through the movement of water among connecting waterways; a number of other fish species, including yellowfin goby (*Acanthogobius flavimanus*) and chameleon goby (*Tridentiger trigonocephalus*), were likely introduced through ballast water discharges from commercial cargo transports traveling primarily from Asia.

In addition, an estimated 100 macroinvertebrate species have been introduced into the estuary, primarily through ballast water discharges (Carlton 1979). Many nonnative aquatic plants have also become established within the estuary. The purposeful and unintentional introductions of nonnative fish, macroinvertebrates, and aquatic plants have contributed to a substantial change in the species composition, trophic dynamics, and competitive interactions affecting the population dynamics of native Delta species. Many of these introduced fish and macroinvertebrates inhabit the central and south Delta.

Water quality variables such as temperature, salinity, turbidity (and associated light levels), DO, pesticides, pH, nutrients (nitrogen and phosphorus), dissolved organic carbon (DOC), chlorophyll, and mercury may influence habitat and food-web relationships in the Delta. Water quality conditions in the Delta are influenced by natural environmental processes, water management operations, and waste discharge practices. Delta water quality conditions can vary dramatically because of year-to-year differences in runoff and upstream water storage releases, and seasonal fluctuations in Delta flows. Concentrations of materials in inflowing rivers are often related to streamflow volume and season. Transport and mixing of materials in Delta channels are strongly dependent on river inflows, tidal flows, agricultural diversions, drainage flows, wastewater effluents, exports, and power plant cooling water diversions and discharges. Water quality objectives and concerns are associated with each beneficial use of Delta water.

PROJECT SITE SETTING

The project islands cover a total of about 20,140 acres; all four project islands are owned by the project applicant, with the exception of the southwest portion of Holland Tract, which is included in the 20,140-acre total. The hydrology and aquatic habitat on and adjacent to the project islands has been highly altered by the construction of levees, which were created to make farming possible. There are a combined total of 56 miles of levees which surround the perimeters of the project islands. The primarily open-water habitat in the channels surrounding the islands and throughout the Delta is relatively shallow (typically less than 20 feet deep) and has a relatively uniform channel bottom comprised of silt, sand, peat, and decomposing organic matter. Tule and other emergent and submerged aquatic vegetation occur both in the open-water areas and along the shoreline margins of sloughs and channels that provide habitat for fish migration, spawning, juvenile rearing, and adult holding and foraging. Although much of the Delta provides shallow open-water aquatic habitat, the channels in the Delta vary in size and hydraulic complexity. Local setting information specific to fish and to wetlands is discussed under separate headings below.

FISHERIES RESOURCES

This section summarizes the life histories and habitat needs of green sturgeon, Chinook salmon, steelhead, delta smelt, and longfin smelt and analyzes the potential for effects from project operations on these species and their habitats. The habitat requirements and distribution of these species are representative of those of other Delta fish species; therefore, effects of project operations described for these species encompass the range of potential project effects on all Delta fish species.

Table 3.4-2
Potentially Affected Special-Status Fish Species

Species	Status Federal/ State	Suitable Habitat	Potential for Project to Affect
Scientific name Common name	--/--		
Acipenser medirostris Green sturgeon	FT/CSC	Found in both marine and freshwater along the entire California coast. Spawns in turbulent, deep, and large freshwater rivers.	**May Affect.** Species may be affected by intake construction and project operations
Hypomesus transpacificus Delta smelt	FT/CE	Open surface waters in the Delta. Seasonally in Suisun Bay, Carquinez Strait, and San Pablo Bay. Found in Delta estuaries with dense aquatic vegetation and low occurrence of predators. May be affected by downstream sedimentation.	**May Affect.** Species may be affected by intake construction and project operations
Oncorhynchus mykiss Steelhead - Central Valley ESU	FT/CSC	This Ecologically Significant Unit (ESU) enters the Sacramento and San Joaquin Rivers and their tributaries from July to May, spawning from December to April. Young move to rearing areas in and through the Sacramento and San Joaquin Rivers, Delta, and San Pablo and San Francisco Bays.	**May Affect.** Species may be affected by intake construction and project operations
Oncorhynchus tshawytscha Central Valley spring-run Chinook salmon	FT/CT	This ESU enters the Sacramento and San Joaquin Rivers and tributaries March to July, spawning from late August to early October. Young move to rearing areas in and through the Sacramento and San Joaquin Rivers, Delta, and San Pablo and San Francisco Bays.	**May Affect.** Species may be affected by intake construction and project operations
Oncorhynchus tshawytscha Winter-run Chinook salmon, Sacramento River	FE/CE	Adults move through the Delta and into the Sacramento River from November to June, spawning from late-April to mid-summer. Young emigrate to the Delta and Bay generally from October to June.	**May Affect.** Species may be affected by intake construction and project operations
Spirinchus thaleichthys Longfin smelt	--/CT	Found predominantly in Suisun and San Pablo Bays and migrate upstream into the Delta to spawn in freshwater from February through April. Larvae move back downstream to the western Delta or Suisun and San Pablo Bays.	**May Affect.** Species may be affected by intake construction and project operations

Notes:

Status Codes:

Federal

FE = Endangered

FT = Threatened

State

CE = Endangered

CT = Threatened

CSC = California Department of Fish and Wildlife Special Concern species

Sources: California Department of Fish and Wildlife 2013

- For this assessment, the term "special-status species" means those species that are either listed, candidates for listing, or proposed for listing as threatened or endangered under ESA or CESA. Table 3.4-2 summarizes information on special-status fish species that have the potential to be affected by the project. Detailed descriptions of distribution and habitat requirements of each of these species are provided below.

Federally listed fish species are legally protected under ESA and include the following:

- Fish listed or proposed for listing as threatened or endangered under ESA (50 Code of Federal Regulations [CFR] Section 17.11 [listed animals] and various notices in the Federal Register [FR]; [proposed species]).

- Fish that are candidates for possible future listing as threatened or endangered under ESA.

- State special-status fish species are legally protected under CESA and include the following:

- Species listed or proposed for listing by the State of California as threatened or endangered under CESA (14 California Code of Regulations [CCR] 670.5).

- Species designated as "species of special concern" by DFW.

Green Sturgeon

Green sturgeon is listed as a threatened species under ESA (National Marine Fisheries Service 2009). Green sturgeon is not listed for protection under CESA; however, it is identified as a California species of special concern. NMFS has designated critical habitat for North American green sturgeon (southern distinct population segment [DPS]), which includes the area of the Delta where the project islands are located.

Life History

San Francisco Bay, San Pablo Bay, Suisun Bay, the Sacramento River, and the Delta support the southernmost reproducing population of green sturgeon. White sturgeon (*Acipenser transmontanus*) is the most abundant sturgeon in the system, and green sturgeon has always been comparatively uncommon. Habitat requirements of green sturgeon are poorly known, but spawning and larval ecologies are probably similar to those of white sturgeon. Adult green sturgeon are adapted to a more marine environment than white sturgeon, spending limited time in estuaries or freshwater (National Marine Fisheries Service 2009).

Indirect evidence indicates that green sturgeon spawn mainly in the higher velocity, deeper reaches of the mainstem Sacramento River; spawning has been reported in the mainstem as far north as Red Bluff. Spawning times in the Sacramento River are presumed to be from March through July, peaking from mid-April to mid-June. Adult sturgeon are in the river, presumably spawning, when temperatures typically range from 46-57°F. Their preferred spawning substrate is large cobble, but substrates range from clean sand to bedrock. Eggs are broadcast spawned and externally fertilized in relatively high water velocities and at depths of less than 10 feet.

Female green sturgeon produce 60,000-140,000 eggs, each approximately 0.15 inch in diameter. Eggs hatch approximately 200 hours after spawning, and larvae are 0.3-0.4 inches long. Juveniles range in size from less than 1 inch to almost 5 feet. Juveniles migrate to sea before 2 years of age, primarily during summer and fall. The occurrence of green sturgeon in fish sampling is extremely low and therefore has not been used to represent the seasonal period of juvenile movement through the Delta. They remain near estuaries as young but may migrate considerable distances as they grow (Moyle 2002).

Green sturgeon grow approximately 3 inches per year until they reach maturity at 4 to 5 feet in length, around age 15 to 20; thereafter, growth rates decline (Wang 1986). The largest fish are thought to be 40 years old, but this estimate may be low. Adults can reach sizes of 7.5 feet and 350 pounds, but in the San Francisco Bay, most are less than 100 pounds (National Marine Fisheries Service 2009). Green sturgeon are benthic feeders (i.e., feeding at the lowest level of a water body) and may also eat small fish. Juveniles in the Delta feed primarily on shrimp, clams, aquatic worms, and amphipods (a type of crustacean).

Factors Affecting Abundance

The primary threat to the southern green sturgeon DPS is the reduction of total spawning habitat (Adams et al. 2007). Access to historical spawning areas has probably been lost because of dams, including Keswick and Shasta on the upper Sacramento River and Oroville Dam on the Feather River. Other threats are additional migration barriers, insufficient flow, increased water temperatures, entrainment in water diversions, nonnative forage species, competitors, predators, poaching, pesticides and heavy metals, and local harvest (Biological Review Team 2005). Young sturgeon survival is probably affected by entrainment in diversions, toxics, and prey availability. Salvage of green sturgeon at the SWP and CVP fish facilities is sporadic and exceeded 100 individuals per year in only 11 of the years from 1980 to 2007. Flows upstream of the Delta have more effect than Delta outflow on sturgeon spawning success.

Presence in the Project Vicinity

Both adult and juvenile North American green sturgeon are known to occur in the lower reaches of the San Joaquin River and in the central and south Delta. Juveniles have been captured in the vicinity of Santa Clara Shoals and Brannan Island State Recreation Area, and in the channels of the south Delta (National Marine Fisheries Service 2006). The occurrence of green sturgeon in fish sampling and SWP/CVP fish salvage is extremely low. As a result, very little information is available on the habitat requirements, geographic distribution, or seasonal distribution of various life history stages of green sturgeon within the estuary. However, adults and juveniles have the potential to occur in the project vicinity throughout the year.

Delta Smelt

The delta smelt was Federally listed as a threatened species on March 5, 1993 (U.S. Fish and Wildlife Service 1993). On December 19, 1994, USFWS designated critical habitat for delta smelt within the Sacramento-San Joaquin River system (U.S. Fish and Wildlife Service 1994). The designation of delta smelt critical habitat extends throughout the Delta and completely encompasses the project islands. Delta smelt are also listed as an endangered species under CESA.

Life History

Delta smelt are a relatively small (2-3 inches long) species with an annual lifecycle, although some individuals may live 2 years. Prior to spawning, adult delta smelt may migrate upstream into the lower reaches of the Sacramento and San Joaquin Rivers, and lower eastside streams, where spawning occurs from approximately February through June, with the greatest spawning activity occurring in April and May in the Sacramento River basin. Females deposit adhesive eggs on substrates such as gravel, rock, and submerged vegetation. Eggs hatch, releasing planktonic larvae which are passively dispersed downstream by river flow. Larval and juvenile delta smelt rear within the estuarine portions of the Delta for a period of approximately 6-9 months before beginning their upstream spawning movement.

Delta smelt generally inhabit the lower reaches of the Sacramento River downstream of Isleton, the San Joaquin River downstream of Mossdale, and the Delta including Suisun Bay. Although juvenile and adult delta smelt are most abundant within the western Delta and Suisun Bay, they may occur within the lower San Joaquin River throughout the year. Delta smelt were once one of the most common pelagic fish in the upper Sacramento/San Joaquin Estuary. Delta smelt have experienced a general decline in population abundance over the past several decades leading to their listing as a threatened species under ESA and endangered under CESA. The causes of decline are multiple and synergistic, including reduction in flows; entrainment losses to water diversions; high outflows; changes in food organisms; toxic substances; disease, competition, and predation; and loss of genetic integrity (State Water Resources Control Board 1999; Baxter et al. 2008). The Interagency Ecological Program

(IEP) continues to evaluate the available scientific information regarding the status of delta smelt and the performance of various management actions designed to improve protection, reduce mortality, and enhance habitat quality and availability for delta smelt within the estuary.

Delta smelt have adhesive eggs that are attached to various substrates during incubation and hence are not vulnerable to entrainment into water diversions. The later life stages of delta smelt are pelagic, living in the open waters of the Delta, and are vulnerable to entrainment into water diversions. Delta smelt larvae, which are planktonic and passively drift with water currents, are present in the project vicinity during late spring and early summer (e.g., late March-June). The juvenile delta smelt typically inhabit cooler areas of the estuary, such as Suisun Bay, during summer when water temperatures in the central and southern Delta are generally unsuitable. Pre-spawning adult delta smelt migrate upstream into the central Delta and lower Sacramento River, including the vicinity of the project islands, during fall and winter when water temperatures in the Delta have seasonally declined to a suitable range. Later during the winter, the adult delta smelt typically migrate farther upstream, primarily in the lower Sacramento River in the vicinity of Cache Slough, the Deep Water Ship Channel, and the mainstem Sacramento River upstream of Rio Vista where they spawn in late winter and spring. The majority of delta smelt die after spawning, although a small number of 2-year-old delta smelt are known to inhabit the estuary.

Factors Affecting Abundance

Delta smelt used to be one of the most common pelagic fish (i.e., living in open water away from the bottom) in the upper Sacramento-San Joaquin estuary. Currently, however, delta smelt populations are threatened due to several factors which include, but are not limited to, the following:

- changes in the seasonal timing and magnitude of freshwater inflow to the Delta and outflow from the Delta;
- entrainment of larval, juvenile, and adult delta smelt into a large number of unscreened water diversions (primary agricultural) located throughout the Delta (Center for Biological Diversity et al. 2006);
- entrainment and salvage mortality at the SWP and CVP water export facilities;
- predation by striped bass, largemouth bass, and a number of other fish species inhabiting the estuary;
- exposure to toxic substances;
- variation in the quality and availability of low-salinity habitat within the Delta and Suisun Bay, in response to seasonal and inter-annual variability in hydrologic conditions within the Delta; and
- reduced food (prey) availability thought to be the result of reduced primary production due, in part, to a reduction in seasonally-inundated wetlands, competition for food resources with nonnative fish and macroinvertebrates (e.g., filter feeding by the nonnative Asian overbite clam *Corbula*), and competition among native and nonnative zooplankton species.

Presence in the Project Vicinity

The project islands lie within the central portion of the current known range of delta smelt. Adults seek shallow, fresh or slightly brackish backwater sloughs and edgewaters for spawning. To ensure egg hatching and larval viability, spawning areas also must provide suitable water quality (i.e., low concentrations of pollutants) and substrates for egg attachment (e.g., submerged tree roots and branches and emergent vegetation) (U.S. Fish and Wildlife Service 1994). Within the project islands, the levee banks support some small patches of rooted emergent vegetation; however, these areas are open to the larger channels and are not protected from currents. The potential for the project island vicinity to provide spawning habitat is low. Delta smelt larvae, juveniles, and adults are all know to occur seasonally in the vicinity and downstream of the project islands as described above under “Life History.”

Central Valley Steelhead

Central Valley steelhead DPS are listed as threatened under ESA. Steelhead are not listed for protection under CESA. Critical habitat for Central Valley steelhead was designated in 2005 and became effective in January 2006. The critical habitat designation for this DPS includes the area around the project islands. The Central Valley steelhead population is composed of both naturally spawning steelhead and steelhead produced in hatcheries. NMFS is continuing to evaluate the status of steelhead and currently is in the process of finalizing a Central Valley salmonid recovery plan for the species.

Central Valley steelhead historically migrated upstream into the high gradient upper reaches of Central Valley streams and rivers for spawning and juvenile rearing. Construction of dams and impoundments on the majority of Central Valley rivers has created impassable barriers to upstream migration and substantially reduced the geographic distribution of steelhead. Although quantitative estimates of the number of adult steelhead returning to Central Valley streams to spawn are not available, anecdotal information and observations indicate that population abundance is low. Steelhead distribution is currently restricted to the mainstem of the Sacramento River downstream of Keswick Dam, the Feather River downstream of Oroville Dam, the American River downstream of Nimbus Dam, the Mokelumne River downstream of Comanche Dam, the Cosumnes River, and a number of smaller tributaries to the Sacramento River system, Delta, and San Francisco Bay. Steelhead have also been reported from tributaries to the San Joaquin River; however, the status of these populations is under investigation.

Life History

Central Valley steelhead are anadromous. Adult steelhead spawn in freshwater and the juveniles migrate to the Pacific Ocean where they reside for a period of years before returning to the river system to spawn. Steelhead that do not migrate to the ocean, but spend their entire life in freshwater, are known as resident rainbow trout.

Adult steelhead migrate upstream during fall and winter (September through February or March) with Central Valley steelhead migration into the upper Sacramento River typically occurring during fall and adults migrating into lower tributaries typically during late fall and winter. Steelhead spawn in areas characterized by clean spawning gravels, cold-water temperatures, and streams that include moderately high-velocity portions. Spawning typically occurs during winter and spring (December-April) with the majority of spawning activity occurring during January and March. Unlike Chinook salmon that die after spawning, adult steelhead may migrate downstream after spawning and return to spawn in subsequent years.

Steelhead spawn by creating a depression in the spawning gravels where eggs are deposited and fertilized (redd). The eggs incubate within the redd for a variable period of time, which is dependent on the water temperature. After hatching, the young steelhead emerge from the gravel redd as fry. The young steelhead rear within the stream system, foraging on insects for 1, 2, or more years before migrating to the ocean. After rearing within the stream, the juvenile steelhead undergo a physiological transformation (smolting) that allows the juvenile steelhead to migrate from the freshwater rearing areas downstream to coastal marine waters. Downstream migration of Central Valley steelhead smolts typically occurs during late winter and early spring (January-May) as reflected in their seasonal occurrence in SWP and CVP fish salvage. The seasonal timing of downstream migration of Central Valley and Central Coast steelhead smolts may vary in response to a variety of environmental and physiological factors including changes in water temperature, changes in stream flow, and increased turbidity resulting from stormwater runoff. The juvenile steelhead rear within the coastal marine waters for approximately 2-3 years before returning to their natal stream as spawning adults.

The steelhead life cycle is characterized by a high degree of flexibility (plasticity) in the duration of both their freshwater and marine rearing phases. The steelhead life cycle is adapted to respond to environmental variability in stream hydrology and other environmental conditions.

Factors Affecting Abundance

Factors affecting steelhead abundance are similar to those described for winter-run and spring-run Chinook salmon. One of the primary factors affecting population abundance of steelhead has been the loss of access to historic spawning and juvenile rearing habitat within the upper reaches of the Sacramento River and its tributaries and the San Joaquin River as a result of the migration barriers caused by construction of major dams and reservoirs. Water temperatures within the rivers and creeks, particularly during summer and early fall months, have also been identified as a factor affecting growth and survival of juvenile steelhead. Juvenile Central Valley steelhead are vulnerable to entrainment at a large number of unscreened water diversions located along the Sacramento River and within the Delta in addition to entrainment and salvage mortality at the SWP and CVP export facilities. Changes in habitat quality and availability for spawning and juvenile rearing, exposure to contaminants, predation mortality, passage barriers and impediments to migration, changes in land use practices, and competition and interactions with hatchery-produced steelhead have all been identified as factors affecting steelhead abundance. Unlike Chinook salmon, steelhead are not vulnerable to recreational and commercial fishing within the ocean, although steelhead support a small inland recreational fishery for hatchery-produced fish. Ocean survival is affected by climatic and oceanographic conditions, and adults are vulnerable to predation mortality by marine mammals.

In recent years a number of changes have been made to improve the survival and habitat conditions for steelhead. Several large, previously unscreened water diversions have been equipped with positive barrier fish screens. Improvements to fish passage facilities have also been made to improve migration and access to spawning and juvenile rearing habitat.

Presence in the Project Vicinity

Although the majority of adult steelhead migrate upstream within the mainstem Sacramento River, some adult steelhead migrate through the central Delta in the vicinity of the project islands and through the south Delta into the San Joaquin River system. Therefore, adult steelhead are present seasonally within the vicinity of the project islands. Adult steelhead would be expected to occur in the south Delta during late fall and winter (about November-March). Juvenile steelhead migrate from the upstream spawning and rearing areas through the Delta, Suisun Bay, and San Francisco Bay, including the channels next to the project islands during winter and early spring (primarily January-May). Steelhead do not spawn in the project area.

Chinook Salmon

Chinook salmon are an anadromous species, spawning in freshwater and spending a portion of their life cycle within the Pacific Ocean. The species is divided into the following four runs according to spawning migration timing and reproductive behavioral differences: winter-run, spring-run, fall-run, and late fall-run. Of the four runs, only the winter-run and spring-run Chinook salmon have been listed for protection under ESA and CESA. These runs of Chinook salmon spawn and rear on the Sacramento River system, but currently do not inhabit the San Joaquin River. Efforts are currently underway to re-establish a self-sustaining population of spring-run Chinook salmon on the San Joaquin River downstream of Friant Dam; however, no spring-run Chinook salmon currently inhabit the area. Results of fish monitoring at the SWP and CVP export facilities, however, show that juvenile winter-run and spring-run Chinook salmon do occur in low numbers in the central and southern Delta during the juvenile emigration period (typically January-May) and therefore have been included in this assessment.

Chinook salmon generally require cool, clean, and well-oxygenated water in streams and rivers that contain adequately sized spawning gravels, instream cover, and riparian shading. Migration barriers in the form of dams, grade control structures, culverts, or water diversion structures substantially limit Chinook salmon access to historical habitat throughout their range. Chinook salmon do not spawn within the Delta in the vicinity of the project islands. However, this species seasonally uses the central and south Delta channels, including Old River, during adult upstream migration, smolt emigration, and juvenile rearing (Moyle 2002). The Delta historically served as an important rearing habitat for juvenile Chinook salmon. The Delta was characterized by extensive shallow water habitats with dendritic channels and emergent wetland vegetation such as tules.

Levee construction and reclamation of wetland areas within the Delta for agriculture and other purposes has substantially modified much of the Delta, reducing the extent of wetlands and increasing the channelization of tributary rivers and Delta islands. Changes in hydrologic conditions resulting from the construction of upstream water storage impoundments and operations for flood control, in combination with increased levels of water diversions both upstream and within the Delta, have contributed to reduced habitat quality and availability for juvenile salmon rearing within the Delta. In addition, the introduction of a number of nonnative fish (e.g., striped bass and largemouth bass) has increased predation mortality for juvenile salmon rearing and migrating through the Delta.

Central Valley Spring-Run Chinook Salmon

Spring-run Chinook salmon are listed as a threatened species under both ESA and CESA. Spring-run Chinook salmon were historically widely distributed and abundant within the Sacramento and San Joaquin river systems (Yoshiyama et al. 1998). Spring-run Chinook salmon historically migrated upstream into the upper reaches of the mainstem rivers and tributaries for spawning and juvenile rearing. Construction of major dams and reservoirs on these river systems eliminated access to the upper reaches for spawning and juvenile rearing and completely eliminated the spring-run salmon population from the San Joaquin River system. Spring-run Chinook salmon abundance has declined substantially and the geographic distribution of the species within the Central Valley has also declined substantially. Spring-run spawning and juvenile rearing currently occurs on a consistent basis within only a small fraction of their previous geographic distribution, including populations inhabiting Deer, Mill, and Butte creeks, the mainstem Sacramento River, several other local tributaries on and intermittent basis, and the lower Feather River. Recent genetic studies have shown that spring-run like Chinook salmon returning to the lower Feather River are genetically similar to fall-run Chinook salmon. Hybridization between spring-run and fall-run Chinook salmon, particularly on the Feather River where both stocks are produced within the Feather River hatchery, is a factor affecting the status of the spring-run salmon population. NMFS is in the process of developing a final recovery plan for Central Valley spring-run Chinook salmon.

Life History

Spring-run Chinook salmon are an anadromous species, spawning in freshwater and spending a portion of their life cycle within the Pacific Ocean. Adult spring-run Chinook salmon migrate upstream into the Sacramento River system during spring, but are sexually immature. Adult spring-run Chinook salmon hold in deep cold pools within the rivers and tributaries over summer prior to spawning. Spawning occurs during the late summer and early fall (late August-October) in areas characterized by suitable spawning gravels, water temperatures, and water velocities. Eggs incubate within the redds, emerging as fry during late fall and winter. A portion of fry appear to migrate downstream soon after emerging where they rear within the lower river channels, and potentially within the Delta estuary, during winter and spring. After emergence, a portion of the spring-run Chinook salmon fry remain as residents in the creeks and rear for a period of approximately 1 year. The juvenile spring-run Chinook salmon that remain in the creeks migrate downstream as yearlings primarily during late fall, winter, and early spring with a peak yearling migration occurring in November (Hill and Weber 1999). The downstream migration of both spring-run Chinook salmon fry and yearlings during late fall and winter typically coincides with increased flow and turbidity associated with winter stormwater runoff.

Factors Affecting Abundance

A variety of environmental and biological factors have been identified that affect the abundance, mortality, and population dynamics of spring-run Chinook salmon. One of the primary factors that have affected population abundance has been the loss of access to historic spawning and juvenile rearing habitat within the upper reaches of the Sacramento River and its tributaries, and the San Joaquin River, as a result of the migration barriers caused by construction of major dams and reservoirs. Operation of the Red Bluff Diversion Dam, which impedes adult upstream migration and increases the vulnerability of juvenile spring-run Chinook salmon to predation mortality, has been identified as a factor affecting mortality within the Sacramento River. Water temperatures within the rivers and creeks have also been identified as a factor affecting incubating eggs, holding adults, and growth and survival of juvenile spring-run Chinook salmon. Juvenile spring-run Chinook salmon are also vulnerable to entrainment at a large number of unscreened water diversions located along the Sacramento River and within the Delta in addition to entrainment and salvage mortality at SWP and CVP export facilities. Changes in habitat quality and availability for spawning and juvenile rearing; exposure to contaminants; predation mortality by Sacramento pikeminnow, striped bass, and other predators; and competition and interactions with hatchery-produced Chinook salmon have all been identified as factors affecting spring-run Chinook salmon abundance. In addition, subadult and adult spring-run Chinook salmon are vulnerable to recreational and commercial fishing, ocean survival is affected by climatic and oceanographic conditions, and adults are vulnerable to predation mortality by marine mammals.

In recent years, a number of changes have been made to improve the survival and habitat conditions for spring-run Chinook salmon. Several large, previously unscreened water diversions have been equipped with positive barrier fish screens. Changes to ocean salmon fishing regulations have been made to improve the survival of adult spring-run Chinook salmon. Modifications to SWP and CVP export operations have also been made to improve the survival of juvenile spring-run Chinook salmon. Improvements in fish passage facilities have also been made to improve migration and access to Butte Creek. These changes and management actions, in combination with favorable hydrologic and oceanographic conditions in recent years, are thought to have contributed to the trend of increasing abundance of adult spring-run Chinook salmon returning to spawn in Butte Creek and other habitats within the upper Sacramento River system in recent years.

Presence in the Project Vicinity

Although the majority of adult spring-run Chinook salmon migrate upstream within the mainstem Sacramento River, a possibility exists that adults may migrate into the central and south Delta. The occurrence of adult spring-run Chinook salmon within the Delta in the vicinity of the project islands is limited primarily to the March-May period of adult upstream migration. Juvenile spring-run Chinook salmon may migrate from the Sacramento River, including its tributaries, into the Delta during their downstream migration and also use the Delta as a foraging area and migration pathway during the winter and early spring migration period. The occurrence of juvenile spring-run Chinook salmon in the vicinity of the project islands occurs during late fall through spring (October-June), when water temperatures within the Delta are suitable for juvenile spring-run Chinook salmon migration. Spring-run Chinook salmon do not spawn in the project vicinity.

Winter-Run Chinook Salmon

Winter-run Chinook salmon are listed as an endangered species under both ESA and CESA. Winter-run Chinook salmon historically migrated into the upper tributaries of the Sacramento River for spawning and juvenile rearing. With the construction of Shasta and Keswick dams, winter-run salmon no longer have access to historic spawning habitat within the upper watersheds. As a result of migration blockage, spawning and juvenile rearing habitat for winter-run Chinook is limited to the mainstem Sacramento River downstream of Keswick Dam. During the mid-1960s, adult winter-run Chinook salmon returns to the Sacramento River were relatively high (approximately 80,000 returning adults). However, the population declined substantially during the 1970s and 1980s. The population decline continued until 1991 when the adult winter-run Chinook salmon population returning to the

Sacramento River was estimated to be less than 200 fish. As a result of the substantial decline in abundance, the species was listed as endangered under both ESA and CESA. During the mid- and late 1990s, the numbers of adult winter-run salmon returning to the Sacramento River gradually increased and the trend of increasing abundance continues to be present.

As with other Chinook salmon stocks, NMFS is continuing to evaluate the status of the winter-run Chinook salmon population and the effectiveness of various management actions implemented within the Sacramento River, Delta, and ocean to provide improved protection and reduced mortality for winter-run salmon, in addition to providing enhanced habitat quality and availability for spawning and juvenile rearing. NMFS has prepared a draft recovery plan for winter-run Chinook salmon.

Life History

Winter-run Chinook salmon are an anadromous species spending 1-3 years within the ocean before migrating upstream into the Sacramento River to spawn. The majority of adult winter-run Chinook salmon returning to spawn are generally 3-year-olds; however, the adult population also includes 2-year-old and 4-year-old Chinook salmon. Adult winter-run salmon migrate upstream through San Francisco Bay, Suisun Bay, and the Delta during winter and early spring (Moyle 2002). Adult winter-run Chinook salmon migrate upstream within the Sacramento River with the majority of adults spawning in the reach upstream of Red Bluff. Winter-run Chinook salmon spawn within the mainstem of the Sacramento River in areas where gravel substrate, water temperatures, and water velocities are suitable. Spawning occurs during spring and summer (mid-April through August; Moyle 2002). Egg incubation continues through fall. Juvenile winter-run Chinook salmon rear within the Sacramento River throughout the year feeding primarily on aquatic insects. Juvenile winter-run salmon (smolts) migrate downstream through the lower reaches of the Sacramento River, Delta, Suisun Bay, and San Francisco Bay during winter and early spring as they migrate from the freshwater spawning and juvenile rearing areas into the coastal marine waters of the Pacific Ocean. The Sacramento River mainstem is the primary upstream and downstream migration corridor for winter-run Chinook salmon. Juvenile winter-run Chinook salmon may migrate from the Sacramento River into the lower reaches of channels within Suisun Marsh during their downstream migration. The migration timing of juvenile winter-run Chinook salmon varies within and among years in response to a variety of factors including increases in river flow and turbidity resulting from winter storms, but generally occurs between early-winter through late-spring months.

Factors Affecting Abundance

A variety of environmental and biological factors have been identified that affect the abundance, mortality, and population dynamics of winter-run Chinook salmon. One of the primary factors that has affected population abundance has been the loss of access to historic spawning and juvenile rearing habitat within the upper reaches of the Sacramento River and its tributaries as a result of the migration barrier caused by Shasta and Keswick Dams. Operation of the Red Bluff Diversion Dam, which historically impedes adult upstream migration and increases vulnerability of juvenile winter-run Chinook salmon to predation mortality, has been identified as a factor affecting mortality within the Sacramento River. In recent years, changes to Red Bluff Diversion Dam gate operations and construction of a new water diversion and fish screen have been made to provide improved access for upstream and downstream migrating winter-run Chinook salmon. Water temperatures within the main stem Sacramento River have also been identified as a factor affecting incubating eggs, holding adults, and growth and survival of juvenile winter-run Chinook salmon rearing in the upper Sacramento River. Modifications to Shasta Reservoir storage and operations and water temperature management have been implemented in recent years to improve water temperature conditions within the upper reaches of the Sacramento River. Juvenile winter-run Chinook salmon are also vulnerable to entrainment at a large number of unscreened water diversions located along the Sacramento River and within the Delta in addition to entrainment and salvage mortality at the SWP and CVP export facilities. Changes in habitat quality and availability for spawning and juvenile rearing; exposure to contaminants and acid mine drainage; predation mortality by Sacramento pikeminnow, striped bass, and other predators; and competition and interactions with hatchery-produced Chinook salmon have all been identified as factors affecting winter-run Chinook salmon abundance. In addition, subadult and adult winter-run Chinook salmon are vulnerable to recreational and commercial fishing, ocean survival is affected by climatic and oceanographic conditions, and adults are vulnerable to predation mortality by marine mammals.

In recent years, a number of changes have been made to improve the survival and habitat conditions for winter-run Chinook salmon. Modifications have been made to reservoir operations for instream flow and temperature management; modifications have been made to the Red Bluff Diversion Dam gate operations; and several large, previously unscreened water diversions have been equipped with positive barrier fish screens. Changes to ocean salmon fishing regulations have also been made to improve the survival of adult winter-run Chinook salmon. Modifications to SWP and CVP export operations have also been made to improve the survival of juvenile winter-run Chinook salmon. These changes in management actions, in combination with favorable hydrologic and oceanographic conditions in recent years, are thought to have contributed to the trend of increasing abundance of adult winter-run Chinook salmon returning to the upper Sacramento River to spawn since the mid-1990s.

Presence in the Project Vicinity

Although the majority of adult winter-run Chinook salmon migrate upstream in the mainstem Sacramento River, a possibility exists that adults may migrate into the central and south Delta and the vicinity of the project islands. The occurrence of adult winter-run Chinook salmon within the central and south Delta would be limited to winter and early spring of adult upstream migration. The majority of adult winter run salmon are thought to migrate upstream through the Delta during the period from about December to March or early April.

During their downstream migration, juveniles may enter into the central Delta via the Delta Cross Channel, Georgiana Slough, or Three Mile Slough. The migration timing of juvenile winter-run Chinook salmon varies within and among years in response to a variety of factors, including increases in river flow and turbidity resulting from winter storms. Thus, potential presence of juvenile winter-run Chinook salmon in the vicinity of the project islands varies by season and among years within the period from December through May. Winter-run Chinook salmon do not spawn within the central or south Delta or the immediate project vicinity.

Longfin Smelt

Longfin smelt are listed as a species of concern under ESA and threatened under CESA. The longfin smelt is a small, slender-bodied fish that measures about 3 inches in length as an adult. The species generally lives for 2 years although some individuals may live to spawn at 3 years of age. Populations of longfin smelt occur along the Pacific Coast of North America, from Hinchinbrook Island, Prince William Sound, Alaska to the San Francisco estuary (Lee et al. 1980). Although individual longfin smelt have been caught in Monterey Bay (Moyle 2002), there is no evidence of a spawning population south of the Golden Gate. The Bay-Delta population is the southernmost, and also the largest, spawning population in California. Small and perhaps ephemeral longfin smelt spawning populations have been documented or suspected to exist in Humboldt Bay, the Eel River estuary, the Klamath River estuary, and the Russian River (Moyle 2002; Pinnix et al. 2004).

Life History

Longfin smelt have a life history that is similar to delta smelt. Both pre-spawning adult delta and longfin smelt migrate upstream into the lower reaches of the rivers during late fall and winter. Longfin smelt have adhesive eggs which are deposited on sand, gravel, rocks, submerged aquatic vegetation, and other hard substrates during spawning. Longfin smelt spawning occurs during late winter and early spring, which is typically 1-2 months before delta smelt spawning. Longfin smelt have planktonic larvae that are transported downstream into the western Delta and Suisun Bay during late winter and spring where juveniles rear. Longfin smelt have a 2-year lifecycle and reside as juveniles and pre-spawning adults in more saline habitat within San Pablo and San Francisco Bays during a majority of their life. Movement patterns based on catches in DFW fish sampling suggest that longfin smelt actively avoid water temperatures greater than 72°F. These conditions occur within the Delta during summer and early fall, when longfin smelt inhabit more marine waters farther downstream in the bays and therefore are not present within the Delta.

Factors Affecting Abundance

A variety of factors are thought to influence the abundance and year class strength of longfin smelt. These factors include seasonal hydrologic conditions (Delta outflow) during late winter and spring; colonization of Suisun Bay and the western Delta by the Asian overbite clam in the mid-1980s exposure to toxins, predation and competition with nonnative species; and sources of direct mortality such as entrainment into the many unscreened water diversions located within the Delta. One of the causal mechanisms potentially contributing to the decline in longfin smelt and other pelagic species inhabiting the estuary is reduced food supplies (i.e., reductions in the abundance of suitable zooplankton), which are caused by foraging of zooplankton by nonnative species such as the overbite clam, and reductions in phytoplankton abundance due to increased concentrations of ammonia or other factors in the Delta. Longfin smelt abundance has also been potentially affected by changes in coastal upwelling (i.e., cold ocean water with high nutrients mixing with surface waters) and production of phytoplankton and zooplankton in coastal marine waters. Statistical analyses (California Department of Fish and Wildlife 2009b) show strong and statistically significant correlations between indices of longfin smelt abundance, based on results of the fall midwater trawl surveys and (a) the magnitude of freshwater flowing into and out of the Delta during late winter and spring which, in turn, influences the location of the low salinity region within the estuary (referred to as the X2 location in km upstream from the Golden Gate Bridge), (b) winter-spring (February-April) air temperature at Davis, and (c) ammonia concentrations observed in the Sacramento River at Hood/Greens Landing during March and September of the previous year. It is also notable that increased Delta outflow is not always a strong indicator of longfin smelt abundance. As just one example, although Delta outflow conditions improved (i.e., outflow increased) in 2003, longfin smelt abundance did not increase (as would be expected based on the outflow-abundance relationship). This finding suggests that an additional factor or factors besides freshwater outflow, such as air temperature or ammonia concentration, may now be limiting the Bay-Delta population abundance of longfin smelt.

Presence in the Project Vicinity

The project islands lie on the eastern edge of the current known range of the species. Similar to adult delta smelt, longfin smelt seek shallow, fresh or slightly brackish backwater sloughs and edgewaters for spawning. To ensure egg hatching and larval viability, spawning areas also must provide suitable water quality (i.e., low concentrations of pollutants) and substrates for egg attachment (e.g., submerged tree roots and branches and emergent vegetation) (U.S. Fish and Wildlife Service 1994). Within the project islands, the levee banks support some small patches of rooted emergent vegetation; however, these areas are open to the larger channels and are not protected from currents. The potential for the project islands and the immediate vicinity to provide spawning habitat is low.

Other Fish Species

Although many other fish species reside in the Bay-Delta estuary, potential effects of project operations are not assessed for most of these species individually because their responses to potential changes in habitat conditions caused by project operations are likely to be similar to those of one or more of the species life stages discussed above. Assessment of project effects on these other species therefore is encompassed by the discussion of potential effects on the species listed above.

Substantial numbers of resident fish are entrained by water diversions, but the actual entrainment effects on populations cannot be easily determined because information on overall population size, screening efficiency (except for a few species), and indirect entrainment losses (e.g., predation caused by delays during migration) is generally unavailable. Based on movement patterns, habitat affinities, and abundance, open-water pelagic fish (e.g., threadfin shad) are probably most susceptible to entrainment in diversions, followed by bottom-feeding catfish and minnows. Species such as sunfish have the lowest susceptibility to entrainment because of their relatively small home ranges and associations with cover.

The number of San Francisco Bay fish species greatly exceeds the number of fish species in the Delta. Biological responses of estuarine and marine species to Delta outflow conditions are highly variable (California Department of Fish and Wildlife 1992; Herrgesell et al. 1983). Some populations remain stable regardless of outflow conditions, particularly species having wide salinity and temperature ranges and a broad range of food requirements (e.g., gobies). Some marine species (e.g., anchovies [*Engraulis mordax*]) may become locally more abundant if salinity increases in response to decreased Delta outflow. Higher Delta outflow may directly or indirectly alter the distribution of estuarine species, thereby affecting intraspecific and interspecific competition (Stevens and Miller 1983; Kimmerer 2002). Higher outflow may increase recruitment of marine species into the San Francisco Bay by increasing landward gravitational flows (two-layered circulation), which improves access to rearing habitat for marine-spawning species like starry flounder.

Invertebrate Species

Invertebrates (i.e., animals without a backbone such as bay shrimp and several zooplankton species) play a key role in the Delta food web. In the conclusion to his 2002 study of the mechanisms linking the abundance of San Francisco estuary fish and invertebrate populations to flow, Kimmerer (2002) states the following:

> Although mechanisms behind the abundance flow relationships in higher trophic levels cannot be deduced from correlative analyses, these mechanisms are unlikely to arise from effects occurring at the base of the food web… For freshwater flow to influence fish and shrimp through the food web would require first that lower trophic levels have positive responses to flow, and that these responses propagate up the food web. Neither of these mechanisms is supported by the results presented here. Taxa in lower trophic levels either did not respond to flow, or they responded inconsistently by season, or with different slopes up to versus after 1987. Most taxa at higher trophic levels, which feed mainly on copepods and mysids during early life, had positive relationships to flow that did not change in slope after 1987, although several changed in intercept, 2 negatively and 1 positively. The large change noted for delta smelt apparently occurred well before the step change at the base of the food web. Thus, the flow response at higher trophic levels was largely uncoupled from variability in lower trophic levels.

A statistically significant negative correlation was found between X2 and abundance/survival of longfin smelt, American shad, striped bass, starry flounder, and bay shrimp—that is to say, the data indicated that abundance/survival indices for these species increased as Delta outflow increased and X2 decreased. The relationship between X2 and the abundance of Pacific herring and delta smelt was not statistically significant. There was little relationship between X2 and the abundance of species in lower trophic orders (including invertebrates such as mysid shrimp and other zooplankton), although the abundance of these species frequently declined after establishment of the Asian Corbula clam in 1987. Only the zooplankton *Eurytemora affinis* demonstrated a statistically significant effect, and this only after 1987.

Kimmerer's analysis (2002a:50-51) suggests that X2 affects most fish not by a bottom-up food chain relationship, but by physical phenomena linked to X2. The lack of response to X2 of lower trophic levels (i.e., invertebrates) supports the conclusion that the proximate mechanisms for most X2-fish relationships are physical phenomena associated with X2. However, Kimmerer et al.'s (2009) update of the previous abundance-X2 analyses and a more explicit examination of changes in habitat size (salinity) did little to support the abundance-habitat quantity hypothesis. Only two fish species (striped bass and American shad) of eight examined showed evidence of habitat quantity increasing and concurrent increases in abundance or survival.

Pelagic Organism Decline

Based on research and monitoring of fish populations in the San Francisco Estuary over the past several decades by a variety of state and Federal agencies, populations of dominant pelagic fishes have been declining at an alarming rate. This phenomenon has been referred to as "pelagic organism decline" or POD. The obvious decline began around 2002 and has affected delta smelt, striped bass, longfin smelt, and threadfin shad. The declines do not appear to correlate with changes in winter-spring outflows as might be expected, but instead have been attributed to the following four general mechanisms: low spawning stock ("stock effects"), perturbation of the food web leading to decreased carrying capacity for POD species ("bottom-up effects"), environmental changes exacerbating the effects of predators and entrainment ("top-down effects"), and general deterioration of habitat quality ("habitat effects").

WETLANDS AND OTHER WATERS OF THE U.S.

The project area is located in the Great Valley ecological region (Miles and Goudy 1997). The Delta Islands formed from the remains of hydrophytic plants and fine-textured mineral deposits associated with the floodplains of the Sacramento and San Joaquin Rivers and historical Delta tidal marshlands (ICF 2001b). The topographic elevation of the islands is below sea level, and flooding is only prevented by perimeter levees and the use of drainage pumps.

Historically, many of the Delta Islands were characterized by brackish marsh. Over time, many of the wetlands in the Delta were converted to other land uses, including extensive agricultural uses, such as those on the project islands. However, wetlands remain on the islands, both in the form of natural wetlands, and in the form of "farmed wetlands."

Wetlands are areas that are characterized by hydrophytic vegetation, hydric soils, and wetland hydrology. USACE regulates activities that result in placement of dredge or fill materials into wetlands under Section 404 of the Clean Water Act and issues guidance for delineating or determining the jurisdictional boundaries of wetlands and other waters of the U.S.

The 1987 Wetland Delineation Manual (U.S. Army Corps of Engineers 1987) and 2008 Regional Supplement (Environmental Laboratory 2010) provide technical guidelines and methods for a three-parameter approach for determining the location and boundaries of jurisdictional wetlands in the Delta. This approach requires that an area support positive indicators of hydrophytic vegetation, hydric soils, and wetland hydrology to be considered a jurisdictional wetland.

The first delineation and of wetlands and other waters of the U.S. on the project islands was conducted in 1994 by the Natural Resources Conservation Service (NRCS), USACE, EPA, and USFWS. This delineation was later updated in 2001 by ICF. The updated delineation was verified by USACE in 2002, and a permit for discharge of dredged or fill of wetlands and other waters of the U.S. was issued by USACE under Clean Water Act Section 404 in the same year. Permit 190109804 required that construction be completed by December 31, 2007. This permit expired before construction began. An updated wetland delineation was conducted by Environmental Sciences Associates in 2011 and was verified by USACE in November 2012 (see Exhibits 3.4-1 through 3.4-4). A new application for the proposed discharge of dredged or fill material under Section 404 of the Clean Water Act was filed with USACE in December 2012 (SPK-1901-09804).

The location and extent of existing wetlands and other waters of the U.S. on the project islands are different than those verified in the 2002 wetland delineation, including the "farmed wetland" category and an overall increase in the acreage of freshwater marsh. All potentially jurisdictional wetlands classified as "exotic marsh" in the 2002 USACE verified delineation (approximately 201 acres) were reclassified as freshwater marsh in the 2012 updated delineation to standardize habitat types closer to accepted habitat classification schemes. See Section 3.5, "Biological Resources," for a detailed description of each wetland type. The 2012 delineation identifies a total of 3,851.7 acres of potentially jurisdictional wetlands and other waters of the U.S. However, this total includes approximately 13.2 acres of wetlands and other waters of the U.S. on Holland Tract that were included in the wetland delineation but are not owned by the project applicant. Therefore, these areas were removed from the calculation of existing wetlands and waters of the U.S. on the project islands for this analysis. As a result, 3,838.5

acres of wetlands and waters of the U.S. are considered existing on the project islands for purposes of this SEIS. This is approximately 2,978.0 acres (approximately 347%) more than the total wetland acreage in the 2002 verified delineation (i.e., approximately 860 acres). The vast majority of this increase (88% of the increase) is due to the newly identified "farmed wetlands". Since 2001, there have also been small increases in acreages of cottonwood-willow woodland and Great Valley willow scrub, and a small decrease in the acreage of permanent ponds. Absent the addition of the farmed wetland category, the total acreage of the project islands delineated as wetlands and waters of the U.S. has increased less than 10%. Table 3.4-3 presents the existing wetlands and other waters of the U.S on the four project islands, based on the wetland delineation verified by USACE in November 2012.

Table 3.4-3
Acreage of Existing Wetlands and Other Waters of the U.S. on the Project Islands[1]

	Reservoir Islands			Habitat Islands			
Wetland Type	Bacon Island	Webb Tract	Total	Bouldin Island	Holland Tract	Total	Total Existing
Wetlands							
Farmed Wetlands	406.5	1,100.5	1,506.9	495.0	614.6	1,109.6	2,616.5
Freshwater Marsh	116.9	159.0	275.9	144.8	166.5	311.2	587.1
Cottonwood-Willow[2]	8.8	112.2	121.0	2.2	89.4	91.6	212.6
Great Valley Willow Scrub[1]	9.2	91.7	100.9	10.5	19.3	29.8	130.7
Tidal Marsh	0.8	0.2	0.9	0	0	0	0.9
Total Wetlands	**542.1**	**1,463.5**	**2,005.6**	**652.4**	**889.8**	**1,542.2**	**3.547.8**
Other Waters							
Canals/Ditches	27.2	33.6	60.8	45.7	18.3	64.0	124.8
Permanent Ponds	0.2	83.3	83.5	1.0	75.0	76.0	159.5
Tidal Channel	3.1	3.2	6.4	0	0	0	6.4
Total Other Waters	**30.6**	**120.1**	**150.7**	**46.7**	**93.2**	**140.0**	**290.7**
Total Wetlands and Other Waters	**572.7**	**1,583.6**	**2,156.3**	**699.1**	**983.0**	**1,682.2**	**3,838.5**

Notes:

1 Excludes 13.2 acres on Holland Tract that are not owned by the project applicant.

2 Cottonwood-willow and Great Valley willow scrub combined make up the forested wetland type.

Source: Environmental Science Associates 2013

3.4.3 REGULATORY FRAMEWORK/APPLICABLE LAWS, REGULATIONS, PLANS, AND POLICIES

Federal applicable laws and regulations are provided because they are required under NEPA. State applicable laws and regulations are provided for informational purposes and to assist with NEPA review. USACE has considered applicable state, regional, and local plans and ordinances as a part of the environmental review process for this SEIS, where applicable.

FEDERAL

Federal Endangered Species Act

Under the ESA, the Secretary of the Interior and the Secretary of Commerce have joint authority to list a species as threatened or endangered (United States Code [USC], Title 16, Section 1533[c]). The ESA prohibits the "take" of endangered or threatened fish and wildlife species, or the take of endangered or threatened plants in areas under Federal jurisdiction or in violation of state law, or adverse modifications to their critical habitat. Under ESA, the definition of "take" is to "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." USFWS and NMFS also interpret the definition of "harm" to include substantial habitat modification that could result in the take of a species.

If an activity would result in the take of a Federally listed species, one of the following is required: an ITP under Section 10(a) of ESA, or an incidental take statement issued pursuant to Federal interagency consultation under Section 7 of ESA. Such authorization typically requires various measures to avoid and minimize take of the species, and to protect the species and avoid jeopardy to the species' continued existence.

Pursuant to the requirements of Section 7 of ESA, a Federal agency reviewing a proposed project which it may authorize, fund, or carry out must determine (1) whether any Federally listed threatened or endangered species, or species proposed for Federal listing, may be present in the project area and (2) whether implementation of the project is likely to affect the species. In addition, the Federal agency is required to determine whether a project is likely to jeopardize the continued existence of a listed species or any species proposed to be listed under ESA or result in the destruction or adverse modification of critical habitat proposed or designated for such species (16 USC 1536[3], [4]).

NMFS administers ESA for marine fish species, including anadromous salmonids such as Central Valley steelhead, winter-run and spring-run Chinook salmon, and green sturgeon. USFWS administers ESA for non-anadromous and non-marine fish species such as delta smelt (and longfin smelt, which has been recently proposed for listing). Projects for which a Federally listed species is present and is likely to be affected by an existing or proposed action must receive authorization from USFWS and/or NMFS. Authorization may involve a letter of concurrence that the project will not result in the potential take of a listed species, or may result in the issuance of a BO that describes measures that must be undertaken to minimize the likelihood of an incidental take of a listed species. A project that is determined by NMFS or USFWS to jeopardize the continued existence of a listed species cannot be approved under a BO.

Where a Federal agency is not authorizing, funding, or carrying out a project, take that is incidental to the lawful operation of a project may be permitted pursuant to Section 10(a) of ESA through approval of a Habitat Conservation Plan (HCP).

The Federal government is required to designate "critical habitat" for any species it lists under ESA. "Critical habitat" is defined as: (1) specific areas within the geographical area occupied by the species at the time of listing, if they contain physical or biological features essential to the species conservation, and those features that may require special management considerations or protection; and (2) specific areas outside the geographical area occupied by the species if the agency determines that the area itself is essential for conservation.

Implementation of the SWP- and CVP-coordinated OCAP, under which Reclamation and DWR jointly manage dam releases to the Delta and exports from the Delta, is a key factor affecting hydrology and aquatic habitat conditions within the Bay-Delta estuary.

OCAP Biological Opinions

Over the past decade since the certification of the 2001 FEIR, two operations-related BOs have been issued for fisheries resources in the Delta. Additionally, POD has become an important issue in the Delta region. These factors have individually and collectively changed the environmental setting of the Delta region as SWP and CVP operations have been modified and other reasonable and prudent alternatives (RPAs) have been implemented to meet the requirements of the BOs.

Two BOs have been issued by USFWS and NMFS, respectively, which address Delta fisheries and have implications on future project water diversions and export. The USFWS OCAP delta smelt BO was issued in 2008 and prescribes alternatives to allow continued SWP and CVP operations. This BO sets the baseline conditions under which Delta waters will be managed. The components of the USFWS BO and its restrictions on Delta water flow are described in detail in Appendix F. The NMFS OCAP BO was issued in 2009 and addresses Delta fisheries more generally with a focus on outmigrating salmonids. Similar to the USFWS OCAP BO, the NMFS OCAP BO prescribes flow-based actions to reduce the risk of mortality to outmigrating salmonids and also includes actions to reduce entrainment at export facilities and improve fish salvage. The components of the NMFS OCAP BO are described in detail in Appendix F.

Magnuson-Stevens Fisheries Conservation and Management Act − Essential Fish Habitat

The Pacific Fisheries Management Council (PFMC) has designated the Delta, San Francisco Bay, and Suisun Bay as Essential Fish Habitat (EFH) to protect and enhance habitat for coastal marine fish and macroinvertebrate species that support commercial fisheries such as Pacific salmon. The amended Magnuson-Stevens Fishery Conservation and Management Act, also known as the Sustainable Fisheries Act (Public Law 104-297), requires that all Federal agencies consult with NMFS on activities or proposed activities that would be authorized, funded, or undertaken by any agency that may adversely affect EFH of commercially managed marine and anadromous fish species.

As part of the OCAP Biological Assessment, Reclamation and DWR have addressed anticipated effects of SWP and CVP operations on EFH within the Bay-Delta estuary for use in the reconsultation for compliance with the act. The EFH provisions of the Sustainable Fisheries Act are designed to protect fisheries habitat from being lost due to disturbance and degradation. The act requires that EFH must be identified for all species Federally managed under PFMC. PFMC is responsible for managing commercial fisheries resources along the coasts of Washington, Oregon, and California. Managed species are covered under three fisheries management plans:

- Pacific Groundfish Fishery Management Plan
- Coastal Pelagic Fishery Management Plan
- Pacific Salmon Fishery Management Plan

The Pacific Groundfish Fishery Management Plan defines the aquatic habitat necessary to allow for groundfish production to support long-term sustainable fisheries for groundfish and groundfish contributions to a healthy ecosystem. The groundfish fishery EFH includes all waters from the mean higher high water line, and the upriver extent of saltwater intrusion in river mouths, along the coasts of Washington, Oregon, and California seaward to the boundary of the U.S. exclusive economic zone. The Coastal Pelagic Fishery Management Plan east-west boundary of EFH is defined to be all marine and estuarine waters from the shoreline along the coast of California, Oregon, and Washington offshore to the limits of the exclusive economic zone and above the thermocline where sea surface temperature range between 10-26°C. Under the Pacific Coast Salmon Fishery Management Plan, the entire San Francisco Bay-Delta estuary has been designated as EFH for spring-, fall-, late fall- and winter-run Central Valley Chinook salmon (Pacific salmon). These areas serve as a migratory corridor, holding area, and rearing habitat for both adult and juvenile salmon.

Clean Water Act

Section 404

USACE is the agency responsible for regulating the discharge of dredged or fill material into jurisdictional wetlands and other waters of the U.S. under Section 404 of the Clean Water Act. EPA has overall responsibility for the Clean Water Act.

Wetlands are ecologically complex habitats that support a variety of plant and animal life. The Federal government defines wetlands as “areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support (and do support, under normal circumstances) a prevalence of vegetation typically adapted for life in saturated soil conditions” (33 CFR Section 328.3[b] and 40 CFR Section 230.3). Under normal circumstances, the Federal definition of wetlands requires evidence of three parameters: wetland hydrology, hydric soils, and hydrophytic vegetation. Examples of jurisdictional wetlands include freshwater marsh, seasonal wetlands, and vernal pools that have a substantial nexus to navigable waterways.

“Other waters of the U.S.” refer to aquatic features that are regulated by the Clean Water Act but are not wetlands (33 CFR Section 328.3). To be considered jurisdictional, these features must exhibit an ordinary high-water mark, and be tributary to or possess a substantial nexus to a navigable waterway. Examples of other waters of the U.S. include rivers, creeks, intermittent channels, ponds and lakes.

Section 404 of the Clean Water Act provides the statutory mechanism for USACE to permit the discharge of dredged or fill material into waters of the U.S. Projects that would result in the placement of dredged or fill material into waters of the U.S. require a permit from USACE. USACE may either issue individual permits on a case-by-case basis or general permits at a program level. For this project, USACE determined that issuing a permit pursuant to Section 404 for the project would be considered a major Federal action under NEPA, and therefore prepared this SEIS to evaluate the effects of those actions.

Section 404(b)(1)

Under Section 404(b)(1) of the Clean Water Act, USACE must comply with the guidelines developed by EPA when approving discharges. The Section 404(b)(1) Guidelines contain the substantive criteria for permitting dredged and fill material discharges under the Clean Water Act (40 CFR Part 230). As part of the public review process, USACE is required to determine whether a project complies with Section 404(b)(1) Guidelines. The Section 404(b)(1) Guidelines prohibit the discharge of dredged or fill materials to waters of the U.S. if there is a “practicable alternative to the proposed discharge that would have less adverse effect on the aquatic ecosystem, so long as the alternative does not have other significant adverse consequences” (40 CFR Section 230.10[a]). Practicable alternatives consist of activities that do not involve a discharge of fill into waters of the U.S. or involve a discharge at another location(s) in waters of the U.S. An alternative is “practicable” if it is “available and capable of being done after taking into consideration cost, existing technology and logistics in light of overall project purposes” (40 CFR Section 230.10[a][2]).

If a proposed activity would involve a discharge into a special aquatic site such as a wetland, the Section 404(b)(1) Guidelines distinguish between those projects that are water dependent and those that are not. A water dependent project is one that requires access to water to achieve its basic purpose (e.g., a marina). A non-water dependent project is one that does not require access to water for its basic purpose (e.g., a university/school). The Delta Wetlands project is a water-dependent project because it diverts, stores, and discharges water.

A Memorandum of Agreement (MOA) between EPA and USACE Concerning the Determination of Mitigation Under the Clean Water Act Section 404(b)(1) Guidelines (1990) summarizes the “sequencing” structure set forth by the Section 404(b)(1) Guidelines: first, avoid effects to waters, second, minimize effects, and third, provide compensatory mitigation for unavoidable effects. In March 2008, EPA and USACE issued the Compensatory

Mitigation Rule (33 CFR Part 332) that provides new standards to ensure no-net-loss of wetlands and emphasizes use of the best available science. This rule reinforces the goal to first avoid and then minimize effects to waters.

In addition to the above provisions, the Section 404(b)(1) Guidelines also prohibit discharges that cause or contribute to violation of water quality standards, violate any toxic effluent limit under Section 307 of the Clean Water Act, jeopardize the continued existence of any listed species, or destroy or modify the critical habitat for any listed species (40 CFR Section 230.10[b]).

Executive Order 11990: Protection of Wetlands

Executive Order 11990 directs all Federal agencies to avoid, to the extent possible, the long- and short-term adverse effects associated with the destruction or modification of wetlands and to avoid direct or indirect wetland effects in support of new construction in wetlands wherever there is a practicable alternative.

Rivers and Harbors Appropriation Act of 1899

The Rivers and Harbors Appropriation Act of 1899 (commonly known as the Rivers and Harbors Act) addresses activities that involve constructing dams, bridges, dikes, or other obstructions across any navigable water. Placement of any obstruction to navigation outside established Federal lines, or excavation from or deposit to material in such waters, requires a permit from USACE. Navigable waters are defined in 33 CFR 329.4 as follows:

> Those waters that are subject to the ebb and flow of the tide and/or are presently used, or have been used in the past, or may be susceptible for use to transport interstate or foreign commerce. A determination of navigability, once made, applies laterally over the entire surface of the waterbody, and is not extinguished by later actions or events which impede or destroy navigable capacity.

Section 10

Section 10 (33 U.S. Code 403) prohibits the unauthorized obstruction or alteration of any navigable water of the U.S. Construction of any structure in or over any navigable water of the U.S., or the accomplishment of other work affecting the course, location, condition, or physical capacity of such waters, is unlawful unless the work has been authorized by the Chief of Engineers.

State

California Endangered Species Act

Pursuant to CESA and Section 2081 of the California Fish and Game Code, a permit from DFW is required for a project that could result in the take of a state-listed threatened or endangered species (i.e., species listed under CESA). Under CESA, the definition of “take” consists of an activity that would directly or indirectly kill an individual of a species, but the state definition does not include “harm” or “harass,” as the Federal definition does. As a result, the threshold for take under CESA is typically higher than that under ESA. Under CESA, DFW maintains a list of threatened species and endangered species (California Fish and Game Code 2070). DFW also maintains two additional lists: (1) a list of candidate species that DFW has formally noticed as being under review for addition to either the list of endangered species or the list of threatened species; and (2) a list of “species of special concern.”

Section 401 Water Quality Certification/Porter-Cologne Water Quality Control Act

Under Section 401 of the Clean Water Act, applicants applying for a Federal license or permit to conduct activities which may result in the discharge of a pollutant into waters of the U.S. must obtain certification from the applicable state water quality agency. For California, SWRCB, acting through the appropriate Regional Water

Quality Control Board (RWQCB), must certify that a USACE permit action does not exceed state water quality objectives.

Discharges to wetlands and “other waters of the state” are also subject to state regulation under the California Porter-Cologne Water Quality Control Act (Porter-Cologne; California Water Code, Division 7, Sections 13000–14958). Water Code Section 13260[a][1] requires “any person discharging waste, or proposing to discharge waste, within any region that could affect the waters of the state to file a report of waste discharge.” The term “waters of the state” is defined as “any surface water or groundwater, including saline waters, within the boundaries of the state” (California Water Code Section 13050[e]). Therefore, whether or not USACE has jurisdiction under Section 404 of the Clean Water Act, SWRCB and RWQCB have jurisdiction to regulate waters of the state by issuing Waste Discharge Requirements or waivers thereof. Pursuant to Resolution No. 2008-0026, SWRCB is developing a policy to protect wetland and riparian areas in support of water quality benefits within the state; this policy has not yet been finalized.

3.4.4 ANALYSIS METHODOLOGY

FISHERIES RESOURCES

The assessment of effects to fisheries resources associated with project operations (i.e., water diversions, export, and beneficial releases [see Chapter 2, “Project Description and Alternatives” in the subsection entitled “Project Releases for Outflow”]) have changed from the 2001 FEIS methodology for Alternatives 1 and 2 primarily due to changes in the affected environment and regulatory framework. The recent USFWS OCAP BO and 2009 NMFS BO along with the emergence of POD contributed to the changes.

A detailed discussion of the present analysis methods for operational effects to fisheries resources for Alternatives 1 and 2 is provided in Appendix F. The analysis methodology was developed and carried out by ICF for the 2010 DEIR and has herein been incorporated in this current SEIS analysis based on its continued relevance and applicability to the project. Operations-related effects under Alternative 3 were modeled for the 2001 FEIS (ICF 2001a:Chapter 3F) and have not changed, primarily because Alternative 3 does not incorporate the FOC. The updated information presented in this section does not change the analysis methodology for construction-related fishery effects or water quality effects on fish from Reservoir Islands discharges containing organic materials and toxins; DO content and temperature of discharged water (particularly with regard to salmonids); and from increases in boating activities (e.g., gasoline and oil spills).

The methods used for assessment of operational effects to fisheries resources developed by ICF for the 2010 DEIR are based on the Delta conditions necessary for relevant life stages of Federal- and state-listed species and include south Delta exports effects that are analyzed under and authorized by the OCAP BOs. Where possible, project effects were evaluated as the estimates of the percentage of a whole population that would be affected. Potential effects of the project operations on fish habitat and survival, as well as entrainment and predation losses, are considered using appropriate fish surveys and export fish salvage data to characterize the existing conditions. Project operations were simulated using the In Delta Simulation Model (IDSM), based on data from CALSIM simulations of Delta inflows and SWP and CVP exports, as well as agricultural and municipal diversions. The IDSM results are provided as Appendix D. Additionally, a particle tracking model (PTM) was used to perform hydrologic simulations with and without proposed project diversion operations to assess changes in the fate of particles, including entrainment onto the Reservoir Islands, as a result of direct diversion of neutrally buoyant particles injected into the model at seven locations throughout the Delta. The assessment of potential entrainment of fish eggs and larvae of delta smelt and longfin smelt is based primarily on the results of the PTM. A detailed discussion of the PTM model is included as Appendix G.

The assessment of operational effects consists of:

- entrainment (fish eggs and larvae in addition to juvenile and adult fish);
- salmonid migration mortality effects;
- changes in estuarine habitat area;
- outflow-linked changes in fish habitat area, survival, and population abundance;
- upstream movement of smelt species caused by project diversions; and
- entrainment loss of zooplankton.

See Appendix F for a complete description of the assessment methodology for entrainment-related project effects along with the results, by species. The assessment includes characteristic indicator species striped bass, white catfish, American shad, and threadfin shad to illustrate the range of effects of simulated project operations on Delta fisheries. These additional species are not Federally or state listed and therefore do not receive consideration in this SEIS analysis; they are included for comparative purposes only.

Alternative 2 (Proposed Action) Operations and Delta Flow

The following subsections provide an overview of: potential losses of fish eggs and larvae by entrainment, potential losses of juvenile and adult fish, potential through-Delta migration mortality of salmonids originating in the Sacramento River watershed, potential changes in estuarine habitat area, potential changes in fish population abundance and survival caused by shifts in X2, potential changes in upstream movement of adult smelt from January to May, and potential entrainment loss of zooplankton from June to September. Details are contained in Appendix F. The information summarized below formed the basis for the effects analysis that is presented in Section 3.4.5, "Environmental Consequences and Mitigation Measures."

Entrainment Loss of Fish Eggs and Larvae

Of the simulated 1billion eggs or larvae produced annually under the 1980–2003 baseline simulation, the annual average percentage loss to the SWP and CVP export facilities was 6.1% for longfin smelt larvae, 7.6% for delta smelt larvae, and 4.8% of striped bass eggs (Table 3.4-4). Baseline losses to Delta agricultural diversions were not estimated quantitatively because the model upon which the estimates of entrainment were based did not include most agricultural diversions. Based on the relative size of the irrigated acreages of agriculture on the project islands and other Delta lowlands agriculture, the baseline lowland agricultural losses would probably be an order of magnitude greater than those of the project. Project diversions (December–March) were estimated to result in average annual losses of 0.4% of longfin smelt larvae, 0.3% of delta smelt larvae, and no striped bass eggs (because the diversion period was before the assumed spawning period of striped bass).

There would be no additive effect of the project's discharge of water for SWP export because no eggs or larvae of longfin smelt, delta smelt, or striped bass species were assumed to occur during July–November. Reduction of agricultural diversions under the project would result in net benefits (e.g., reductions in entrainment of larvae) of 0.5–1.7% of the baseline SWP/CVP entrainment loss. Overall, the project would result in a net average annual benefit (i.e., reduced loss due to reductions in project agricultural diversions) of 0.1% reduced entrainment loss of striped bass eggs, with a range over all years from 0.0–0.2%. The average annual net effect on longfin smelt larvae was projected to be a 0.4% loss of all larvae, with a range over all years from a 1.5% loss to a 0.1% reduced loss (i.e., reduction of agricultural diversions under the project more than offset Reservoir Island diversions in some years). For delta smelt larvae, the average annual net effect was projected to be a loss of 0.2% of all larvae, with a range over all years from 2.3% of all larvae lost to a reduction in annual loss of 0.2% (Table 3.4-4).

Table 3.4-4
Average Annual Egg and Larval Entrainment Loss Attributable to the Project under Alternative 2 (Proposed Action) in Relation to the Baseline, Based on Simulated Conditions (1,000,000,000 Eggs or Larvae Released Per Year) from 1980 to 2003

	Simulated Baseline SWP/CVP Entrainment[1]		Project Diversion Entrainment Effect[2]			Project Export Entrainment Effect[3]		Baseline DW Ag. Diversion[4]	Project Habitat Diversion[5]	Project Benefit from Reduced Agricultural Diversions[6]		Net Project Effect	
Fish Species	Loss	% of All Eggs/ Larvae	Loss	% of CVP/ SWP	% of All Eggs/ Larvae	Loss	% of All Eggs/ Larvae	Loss	Loss	Reduced Loss	% of CVP/ SWP Loss	% of CVP/ SWP Loss	% of All Eggs/ Larvae
Longfin smelt (larvae)	60,594,236	6.1	4,082,540	6.9	0.4	0	0.0	576,761	196,854	379,907	0.5	6.4	0.4
Delta smelt (larvae)	76,369,550	7.6	2,515,689	2.9	0.3	0	0.0	1,045,637	218,344	827,292	1.0	1.9	0.2
Striped bass (eggs)	48,186,950	4.8	0	0.0	0.0	0	0.0	1,075,219	202,738	872,481	1.7	-1.7	-0.1

Notes: CVP = Central Valley Project; SWP = State Water Project

1 Assumes 1,000,000,000 eggs or larvae of each species were released annually at various locations (Appendix F).

2 Assumes diversions from December to March.

3 Assumes discharge for exports by SWP from July to November.

4 Assumes similar pattern of agricultural diversions each year.

5 Assumes similar pattern of habitat diversions each year.

6 Benefit is calculated as reduction in agricultural diversion entrainment loss minus increase in habitat diversion entrainment loss.

Source: ICF 2010:4.5-72; adapted by Environmental Science Associates in 2013

Entrainment Loss of Juvenile and Adult Fish

Under the baseline 1980–2003 conditions, the average annual entrainment loss of small juvenile and adult fish at the SWP and CVP export facilities ranged from about 240 green sturgeon to over 20 million striped bass (Table 3.4-5). The annual entrainment loss to baseline agricultural diversions in the Delta lowlands ranged from 17 green sturgeon to over 1.5 million striped bass. The average annual entrainment loss to the Reservoir Islands was projected to range from 0 delta smelt juveniles and green sturgeon to almost 5,000 threadfin shad; in general, the percentage of fish directly lost to project diversions was projected to be a very small percentage of fish lost due to the baseline exports, ranging from 0.0% for most species to 0.2% for winter-run and late-fall-run Chinook salmon and delta smelt adults (Table 3.4-6). The number of fish entrained during export of project water by the magnitude. The net effects of the project were assessed by summing the loss of fish at the project diversions (Reservoir and Habitat Islands) and the loss of fish due to exports of Reservoir Islands water by SWP and CVP; from this total, the reduced fish loss due to the reduction of unscreened agricultural diversions was subtracted. The final result was expressed as both a percentage of the baseline loss at the SWP/CVP export facilities and a total number of fish. This suggested that the project had a net effect (i.e., an annual average loss of fish) on most species, ranging from an average annual loss of five green sturgeon (2.6% of the baseline SWP/CVP loss) to a loss of over 390,000 striped bass (2.5% of the baseline SWP/CVP loss). The net effect of the project was generally low for listed salmonids; the average annual loss was projected to be 28 steelhead and 89 winter-run

Table 3.4-5
Average Annual Entrainment Loss of Juvenile and Adult Fish Attributable to the Project under Alternative 2 (Proposed Action) Compared to the Baseline, Based on Simulated Conditions from 1980 to 2003

Fish Species	Baseline SWP/CVP Loss[1]	Baseline Delta Lowland Agriculture Loss[2]	Project Diversion Effect[3]		Project Export Effect[4]		Baseline Project Agricultural Diversion Loss[5]	Project Habitat Diversion Loss[6]	Project Benefit from Reduced and Screened Agricultural Diversions[7]		Net Project Effect	
			Loss	% of Baseline SWP/CVP	Loss	% of Baseline SWP/CVP			Reduced Loss	% of SWP/CVP	Loss	% of SWP/CVP
Chinook salmon (fall-run)	291,019	10,571	74	0.0	311	0.1	529	6	523	0.2	-138	0.0
Chinook salmon (late fall–run)	20,190	202	52	0.2	79	0.4	10	0	10	0.1	121	0.6
Chinook salmon (winter-run)	60,420	633	120	0.2	0	0.0	32	1	31	0.1	89	0.1
Chinook salmon (spring-run)	130,901	852	26	0.0	0	0.0	43	0	42	0.0	-16	0.0
Steelhead	23,178	202	32	0.1	6	0.0	10	0	10	0.0	28	0.1
Striped bass	20,639,124	1,556,731	2,354	0.0	466,038	2.9	77,837	879	76,958	0.4	391,435	2.5
White catfish	1,570,376	77,919	585	0.0	54,509	4.0	3,896	50	3,846	0.3	51,247	3.7
American shad	3,768,712	151,216	2,763	0.1	129,383	3.8	7,561	115	7,446	0.2	124,699	3.7
Threadfin shad	9,728,832	448,606	4,798	0.0	402,914	4.6	22,430	313	22,117	0.2	385,595	4.4
Longfin smelt	134,017	2,279	10	0.0	195	0.2	114	1	113	0.1	92	0.1
Delta smelt (adults)[a]	33,571	256	62	0.2	0	0.0	13	0	13	0.0	50	0.1
Delta smelt (juveniles)[b]	261,643	11,279	0	0.0	2,528	1.3	564	2	562	0.3	1,966	1.1
Green sturgeon	242	17	0	0.1	6	2.9	1	0	1	0.4	5	2.6

Table 3.4-5
Average Annual Entrainment Loss of Juvenile and Adult Fish Attributable to the Project under Alternative 2 (Proposed Action) Compared to the Baseline, Based on Simulated Conditions from 1980 to 2003

			Project Diversion Effect[3]		Project Export Effect[4]				Project Benefit from Reduced and Screened Agricultural Diversions[7]		Net Project Effect	
Fish Species	Baseline SWP/CVP Loss[1]	Baseline Delta Lowland Agriculture Loss[2]	Loss	% of Baseline SWP/CVP	Loss	% of Baseline SWP/CVP	Baseline Project Agricultural Diversion Loss[5]	Project Habitat Diversion Loss[6]	Reduced Loss	% of SWP/CVP	Loss	% of SWP/CVP

Notes: SWP = State Water Project; CVP = Central Valley Project

[1] Based on average of monthly fish densities at salvage (fish/taf) extrapolated to account for pre- and post-salvage losses and multiplied by export flows.

[2] Assumes baseline loss is 20 times that of the Delta Wetlands agricultural diversion loss (based on Delta Wetlands being 5% of irrigated Delta acreage).

[3] Assumes diversions from December to March, 50% small-intake correction, and 95% screening efficiency.

[4] Increased loss of fish assuming SWP and CVP export of all discharged project water from July to September.

[5] Assumes similar pattern of agricultural diversions each year, and 10% small-intake correction.

[6] Assumes 95% screening efficiency, 10% small-intake correction, and similar pattern of habitat diversions each year.

[7] Calculated as entrainment loss to existing Delta Wetlands agricultural diversions minus entrainment loss to project wetland habitat diversions.

[a] All delta smelt entrained from December to March and 25% entrained in April were assumed to be adults.

[b] All delta smelt entrained from May to November and 75% entrained in April were assumed to be juveniles.

Source: ICF 2010:4.5-75 and -76; adapted by Environmental Science Associates in 2013

Table 3.4-6
Comparison of Minimum, Average, and Maximum Net Entrainment Losses Attributable to the Project under Alternative 2 (Proposed Action)

	Minimum		Average		Maximum	
Fish Species	Loss	% of SWP/CVP	Loss	% of SWP/CVP	Loss	% of SWP/CVP
Chinook salmon (fall-run)	-502	-0.3	-138	0.0	1,039	0.3
Chinook salmon (late fall–run)	-10	-0.1	121	0.6	894	4.5
Chinook salmon (winter-run)	-31	-0.1	89	0.1	392	0.5
Chinook salmon (spring-run)	-42	-0.1	-16	0.0	204	0.3
Steelhead	-8	-0.1	28	0.1	110	0.5
Striped bass	-74,672	-0.5	391,435	2.5	1,837,003	18.9
White catfish	-3,316	-0.2	51,247	3.7	158,799	16.8
American shad	-4,090	-0.1	124,699	3.7	377,103	17.0
Threadfin shad	-15,988	-0.2	385,595	4.4	1,184,302	18.9
Longfin smelt	-105	-0.2	92	0.1	440	0.7
Delta smelt (adults)[a]	-13	-0.1	50	0.1	92	0.3
Delta smelt (juveniles)[b]	-562	-0.3	1,966	1.1	8,458	8.3
Green sturgeon	-1	-0.4	5	2.6	19	15.7

Notes: CVP = Central Valley Project; SWP = State Water Project

[a] All delta smelt entrained from December to March and 25% entrained in April were assumed to be adults.

[b] All delta smelt entrained from May to November and 75% entrained in April were assumed to be juveniles.

Source: ICF 2010:4.5-77; adapted by Environmental Science Associates in 2013

Chinook salmon. There was actually a projected net benefit of the project to spring-run Chinook salmon because the migration season largely avoids the periods of project storage diversions and discharges to export, so that the reduction and screening of existing agricultural diversions outweighs the small loss due to diversions and discharges. The loss of juvenile and adult delta smelt was projected to comprise annual averages of 50 and almost 2,000 individuals, respectively, or 0.1% and 1.1% of the baseline SWP/CVP mortality.

The annual ranges of net entrainment effects are detailed in Appendix F and are summarized in Table 3.4-6. The minimum net entrainment effect on all species was actually a reduced loss compared to the loss that occurred due to existing unscreened agricultural diversions on the project islands. The projected loss ranged from one less entrained green sturgeon (-0.4% of baseline SWP/CVP entrainment losses) to almost 75,000 less entrained striped bass (-0.5% of baseline SWP/CVP losses). The maximum annual entrainment loss was projected to range from 19 green sturgeon (15.7% of baseline SWP/CVP loss) to over 1.8 million striped bass (around 19% of baseline SWP facility ranged from 0 (winter-run and spring-run Chinook salmon and delta smelt adults) to almost 470,000 (striped bass). The project discharges are estimated to increase entrainment loss during July–November exports by about 3–4.5% for a number of species (striped bass, white catfish, American shad, threadfin shad, and green sturgeon) and by 0.0–0.6% for all salmonids, longfin smelt, and delta smelt adults.

Existing unscreened agricultural diversions on the project islands were estimated to entrain an average of more than 100,000 fish per year, including more than 560 juvenile delta smelt (Table 3.4-6). These levels of entrainment exceeded the entrainment attributable to Habitat Island diversions under the project by two orders of SWP/CVP loss). The maximum loss for several listed salmonids was estimated to be 0.5% or less of the baseline SWP/CVP loss (i.e., winter-run and spring-run Chinook salmon, and steelhead). Maximum losses for delta smelt were 0.3% of baseline SWP/CVP losses for adults and 0.7% for juveniles; maximum losses of longfin smelt were also 0.7% of baseline SWP/CVP losses.

For a discussion of the analysis that was performed to illustrate the effects of changing the small-intake correction factor, see Appendix F. Note that the entrainment attributable to export of discharged water from the project islands is likely to be a worst-case estimate because the project is making available a quantity of fish-free water that has been stored until July–November. In theory, this fish-free water should not greatly increase the entrainment of fish, except possibly for those fish between the project islands and the export facilities in the south Delta. The modeling did not attempt to adjust for this potential effect and conservatively assumed that entrainment would occur at rates similar to those observed historically.

Effects of Old and Middle River Flows on Delta Smelt Loss

Baseline December–March losses of delta smelt adults due to entrainment at the SWP/CVP export facilities from 1980 to 2003 averaged 10.7% of the population (range: 0–14.8%) (Exhibit 3.4-5). Additional losses due to project diversions decreasing Old and Middle River (OMR) flows averaged 0.70% of the population (range: 0–0.93%) (Exhibit 3.4-5).

Baseline March–June losses of delta smelt larvae/juveniles due to entrainment at the SWP/CVP export facilities from 1980 to 2003 averaged 17.4% of the population (range: 0–27.0%) (Exhibit 3.4-6). Additional losses due to DW project diversions decreasing OMR flows averaged 0.24% of the population (range: 0–1.99%) (Exhibit 3.4-6).

As detailed in Appendix F, the methodology for this analysis assumed that project diversions would increase the position of X2 and decrease OMR flows, potentially leading to increased losses of delta smelt at the SWP/CVP export facilities. It was also assumed that the additional entrainment would be the same as if the export facilities had increased exports by the same flows as were diverted to the project islands. Note that the methodology described above in “Entrainment Loss of Juvenile and Adult Fish” focused both on entrainment losses during diversions through the project’s screened intakes and also on entrainment losses at the SWP/export facilities during export of water discharged from the Reservoir Islands.

Through-Delta Migration Mortality of Juvenile Sacramento River and Mokelumne River Salmonids

An average of 19.3% of Sacramento River fall-run Chinook salmon juveniles entered the central Delta and baseline mortality due to exports, predation, or water quality amounted to nearly 14% of the total juveniles entering the Delta from Sacramento River (Table 3.4-7). The additional loss attributable to the project was projected to be very low—approximately 0.01% of the total fish. This was due to the main fall-run outmigration period coinciding with no project diversions (i.e., April and May). Over 35% of late-fall-run Chinook salmon were estimated to enter the central Delta, resulting in relatively high estimated baseline mortality (approximately 28.5%) and an estimated mortality attributable to the project of 0.23%. Winter-run Chinook salmon had a somewhat lower average estimated mortality attributable to project operations than late-fall-run (0.12%), whereas spring-run had very low estimated mortality attributable to the project (0.01%). This latter result was again because the main spring-run outmigration would occur after project diversions had ceased.

Table 3.4-7
Average Annual Mortality Losses of Juvenile Sacramento River Salmonids Migrating through the Delta under Simulated Baseline and Alternative 2 (Proposed Action) Conditions

	Whole Population Estimates %			Baseline % Loss (SWP/CVP + Predation/Water Quality Losses in Central Delta)	Project % Loss
	Total Loss	Sacramento River Loss (assumed)	Entering Central Delta		
Chinook salmon (fall-run)	23.9	10.0	19.3	13.9	0.02
Chinook salmon (late fall–run)	38.7	10.0	35.2	28.5	0.23
Chinook salmon (winter-run)	25.3	10.0	19.0	15.2	0.12
Chinook salmon (spring-run)	22.9	10.0	18.2	12.9	0.01
Steelhead	23.9	10.0	18.0	13.8	0.07

Notes: SWP = State Water Project; CVP = Central Valley Project

Source: ICF 2010:4.5-88; adapted by Environmental Science Associates in 2013

Sacramento River-origin steelhead were intermediate in mortality estimates compared to the various runs of Chinook: an average of 18% entered the central Delta and almost 14% were lost to baseline mortality, with an additional 0.07% being lost to the effects of the project (Table 3.4-7).

The estimated minimum annual mortality was 0.00% for all juvenile salmonids and maximum annual mortality ranged from 0.05% in fall-run Chinook salmon to 0.99% in late-fall-run Chinook salmon (Table 3.4-8).The results for the Mokelumne River-origin fall-run Chinook salmon and steelhead modeling indicated that several times higher percentage losses would occur from the project than for Sacramento River-origin fish. This was due to all individuals within the populations having to pass through the central Delta. The average percentage loss for fall-run Chinook salmon was projected to be 0.09% (range: 0.02-0.38%) and for steelhead the average loss was projected to be 0.41% (range: 0.00-1.32%).

Changes in Estuarine Habitat Area

The effects of project diversions and SWP/CVP export of discharged project Reservoir Island water were modeled for longfin smelt, delta smelt, and striped bass. For the 1980–2003 period under the baseline, the average annual area of optimal salinity habitat ranged from 51.0 square kilometers (km^2) (delta smelt) to 159.9 km^2 (longfin smelt) (Table 3.4-9). Average annual effects to optimal salinity habitat area attributable to the project ranged from a projected gain (i.e., a benefit) of 0.04 km^2 (delta smelt) to a projected loss of 0.26 km^2 (longfin smelt). These reductions represented proportional decreases of 0.09–0.17% compared to the baseline.

Table 3.4-8 Comparison of Average, Minimum, and Maximum Sacramento River Salmonid Migration Mortality Losses Attributable to the Project under Alternative 2 (Proposed Action)			
	% Loss		
	Minimum	Average	Maximum
Chinook salmon (fall-run)	0.00	0.02	0.08
Chinook salmon (late fall–run)	0.00	0.23	0.99
Chinook salmon (winter-run)	0.00	0.12	0.39
Chinook salmon (spring-run)	0.00	0.01	0.07
Steelhead	0.00	0.07	0.23

Source: ICF 2010:4.5-88; adapted by Environmental Science Associates in 2013

Table 3.4-9 Average Annual Reduction in Optimal Salinity Habitat Area Attributable to the Project under Alternative 2 (Proposed Action) in Relation to the Baseline, Based on Simulated Conditions from 1980 to 2003					
		Area of Optimal Salinity Habitat			
	Optimal Salinity Range[a]	Baseline (km^2)	Alternative 2 (km^2)	Project Effect (Reduced Area, km^2)	Project Effect (%)
Longfin smelt (larvae and early juveniles)[b]	1.1–18.5 ppt	159.89	159.63	0.26	0.17
Delta smelt (larvae and early juveniles)[c]	0.3–1.8 ppt	50.99	51.03	-0.04	-0.09
Striped bass (larvae)[d]	0.1–2.5 ppt	75.55	75.45	0.11	0.16

Notes: km^2 = square kilometers; ppt = parts per thousand

[a] Based on the 10th and 90th percentiles of the salinity distribution.

[b] Estimated by ICF from 16 years of DFW's Egg and Larval Survey data (Unger 1994).

[c] Estimated by ICF from 2 years of DFW's Egg and Larval Survey data (Unger 1994).

[d] Estimated by DFW from IEP Delta Outflow/San Francisco Bay Study Program data (Unger 1994).

Source: ICF 2010:4.5-89; adapted by Environmental Science Associates in 2013

Over the baseline period, modeling indicated that the project would result in beneficial increases in estuarine habitat area for longfin smelt (2.34 km^2 or 1.24% of baseline) and delta smelt (0.90 km^2 or 1.90% of baseline). Modeling also indicated that the project would result in decreases in optimal salinity habitat of 1.65 km^2 for striped bass (2.44% of baseline), 5.74 km^2 for longfin smelt (3.10% of baseline), and 0.79 km^2 for delta smelt (1.61% of baseline).

Changes in Fish Population Abundance and Survival Caused by Shifts in X2

The estimated FMWT index of longfin smelt under project conditions was estimated to be on average just over 1% (1.02%) lower than the baseline for the 1967–2003 period (Exhibit 3.4-7). The maximum reduction was 3.7% in 1981, a year in which the FMWT was moderately low. Four years had higher FMWT indices under project operations (including a 1.1% increase in 1994) than the baseline. The average 1967–2003 FMWT index of American shad was projected to be 0.25% lower under the project than the baseline (Exhibit 3.4-8). The maximum reduction (1.2%) under the project was estimated to occur in 1992, and the project was estimated to exhibit increases in FMWT index for four years (0.01–0.13%). The survival index of striped bass under the project was estimated to be on average 0.12% lower than the baseline for the 1978–2003 period (Exhibit 3.4-9).

For delta smelt, the predicted summer townet (STN) Index was estimated to increase by an average of almost 1.2% under the project compared to the baseline conditions, when using the actual FMWT index values (Exhibit 3.4-10). This was due to the assumption of beneficial releases of water during fall (September-November) of some years. The maximum increase was predicted to be 6.0% above baseline and the greatest decrease was predicted to be 0.7% below baseline. Adopting annually constant FMWT index values of 23, 280, and 1,000 gave average predicted STN indices that were 6.1%, 2.0%, and 0.8% higher than baseline.

Changes in Upstream Movement of Adult Smelt from January to May

The percentage of delta smelt upstream of the confluence of the Sacramento and San Joaquin Rivers during the January–May Kodiak Trawl surveys was not related to the location of X2 (Exhibit 3.4-11). Sommer et al. (1997) found that although delta smelt were salvaged more frequently in dry years (Sacramento Valley runoff index below 7.8), the difference in salvage was not statistically significant between wet and dry years (Mann-Whitney test, $P < 0.10$). USFWS (2008:212) noted that "there is wide, apparently random variation in the use of the central and south Delta by spawning delta smelt." The results of the analysis of potential effects of project diversions on distribution of adult delta smelt support this statement. No longfin smelt were observed upstream of the confluence during the spring Kodiak trawl survey for the subset of trawl stations used in the analysis. Therefore, a comparison of the potential flow-related effects of the project to the baseline was not undertaken for this species.

Entrainment Loss of Zooplankton from June to September

The estimated baseline June–September cumulative abundance of *Pseudodiaptomus forbesi* in the regions for which zooplankton density data were available averaged from 4.7 × 1011 (470 billion) in the southeast Delta to 2.2 × 1012 (2.2 trillion) in the Franks Tract region during 1989 to 2003 (Table 3.4-10). It was assumed (based on particle tracking results) that there would be no entrainment loss of *P. forbesi* inhabiting Suisun Bay, Suisun Marsh, and Chipps Island regions because of the distance from the exports and the project. In regions for which entrainment losses were estimated, average baseline losses to SWP/CVP entrainment ranged from 23% (from the lower Sacramento River) to 99% (from the southeast Delta). The additional entrainment estimated to occur because of project discharge of water for export by SWP was almost 0 for *P. forbesi* from the southeast Delta (because baseline pumping already had caused nearly all of the losses possible given the assumed export-to-import ratio (E/I)-loss relationship). Estimates of total loss attributable to project entrainment were greatest from Franks Tract (3.6%).

The average benefit of the project in terms of reduced agricultural diversions ranged from 0.1% in the southeast Delta to 1.5% in Franks Tract. The net projected effect of the project was greatest for the lower Sacramento River (an average of 2.2% loss to entrainment). There was a project net benefit of the project to the east-southeast Delta consisting of an average 0.1% decreased entrainment loss (primarily because of decreased agricultural diversions in June) (Table 3.4-10).

Combining the results for all regions for which zooplankton density data were available required removal of several months of data because not all regions were sampled throughout 1989–2003. Overall, from an average cumulative June–September population size of 8.4 × 1012 (8.4 trillion) *P. forbesi*, it was estimated that around 42% were lost to baseline SWP/CVP entrainment (Table 3.4-10). Additional SWP entrainment losses attributable to the project discharges for export were estimated to contribute a further 1.9% average loss to the zooplankton population, but reduction of agricultural diversions with the project reduced the estimated average net effect to 1.2% (Table 3.4-12). The maximum annual effect of the project was estimated to be a net loss of 6.1% of all *P. forbesi* and the minimum effect was estimated to result in a reduced loss (compared to the baseline) of 1.5%.

It is possible that zooplankton populations on the Reservoir Islands would increase in size following diversion onto the islands, as they would be in a relatively fish-free habitat with few predators. Thus, discharge of zooplankton-rich water may compensate for project losses attributable to export of discharged water. The scenario analyzed above therefore excludes a potential benefit from the project island discharges.

Table 3.4-10
Average June–September *Pseudodiaptmous forbesi* Loss Attributable to the Project under Alternative 2 (Proposed Action) in Relation to the Baseline, based on Extrapolations of Observed Zooplankton Density Data from 1989 to 2003

	Cumulative Population size[1]	Baseline SWP/CVP Exports % Loss	Project Discharges for Export % Loss[2]	Baseline Project Agricultural Diversion % Loss[3]	Project Habitat Diversion % Loss[4]	Project Benefit from Reduced Agricultural Diversions (Reduced % Loss)[5]	Net Project Effect (% Loss)
Suisun Bay	506,177,232,624	0.00	0.00	0.00	0.00	0.00	0.00
Suisun Marsh	882,595,467,199	0.00	0.00	0.00	0.00	0.00	0.00
Chipps Island	530,523,864,861	0.00	0.00	0.00	0.00	0.00	0.00
Lower Sacramento River	1,483,020,608,272	23.01	3.00	1.09	0.31	0.77	2.23
Lower San Joaquin River	1,262,742,998,170	27.44	2.95	1.33	0.37	0.96	1.99
Franks Tract	2,202,689,903,129	43.92	3.59	1.97	0.51	1.47	2.13
East-southeast Delta	1,483,020,608,272	95.12	0.17	0.80	0.19	0.61	-0.44
Southeast Delta	469,836,828,071	99.00	0.00	0.15	0.04	0.11	-0.11
All regions[6]	8,380,078,392,871	41.69	1.93	1.06	0.28	0.78	1.15

Notes: SWP = State Water Project; CVP = Central Valley Project

1 The cumulative population size is the sum of the extrapolated monthly abundance estimates from June to September.

2 Assumes discharge for exports by SWP from July to November.

3 Assumes similar pattern of agricultural diversions each year.

4 Assumes similar pattern of habitat diversions each year.

5 Benefit is calculated as reduction in agricultural diversion entrainment loss minus increase in habitat diversion entrainment loss.

6 A subset of months was used for the all-region summary because not all regions were sampled in all months.

Source: ICF 2010:4.5-98; adapted by Environmental Science Associates in 2013

Table 3.4-11 Relative Entrainment Effects of Alternative 2 (Proposed Action) and Alternative 3 (Doubling of Diversions to the Reservoir Islands and Doubling of Discharges for Export) for Larval Delta Smelt and Longfin Smelt				
	Alternative 2 (Proposed Action)		Alternative 3	
	Number of Larvae	% of All Larvae	Number of Larvae	% of All Larvae
Longfin smelt	4,082,540	0.4	9,660,515	1.0
Delta smelt	2,515,689	0.2	4,275,036	0.4

Note: Results are annual averages based on a 1980-2003 baseline period.
Source: ICF 2010:4.5-110; adapted by Environmental Science Associates in 2013

Table 3.4-12 Relative Entrainment Effects of Alternative 2 (Proposed Action) and Alternative 3 (Doubling of Diversions to the Reservoir Islands and Doubling of Discharges for Export) for Juvenile and Adult Fish				
	Alternative 2 (Proposed Action)		Alternative 3	
	Number of Fish	% Change from Baseline SWP/CVP Loss	Number of Fish	% Change from Baseline SWP/CVP Loss
Chinook salmon (fall-run)	-138	0.0	243	0.1
Chinook salmon (late fall-run)	121	0.6	252	1.2
Chinook salmon(winter-run)	89	0.1	210	0.4
Chinook salmon (spring-run)	-16	0.0	9	0.0
Steelhead	28	0.1	66	0.3
Longfin smelt	92	0.1	295	0.3
Delta smelt (adults)	50	0.1	113	0.3
Delta smelt (juveniles)	1971	1.1	4,493	2.4
Green sturgeon	5	2.6	12	5.6

Note: SWP = State Water Project; CVP = Central Valley Project; results are annual averages base on a 1980-2003 baseline period.
Source: ICF 2010:4.5-110; adapted by Environmental Science Associates in 2013

Alternative 3 Operations and Delta Flow

Compared to Alternative 2, Alternative 3 would double the diversions to the project islands and would double discharge of water for export and outflow; there would be no diversions for habitat. Two quantitative examples are provided by reexamining the analyses of entrainment and assuming that under Alternative 3 project diversions and discharges are doubled, with no Habitat Island diversions (Tables 3.4-11 and 3.4-12). Examples of larval entrainment of smelts show that the projected losses could be more or less than two times greater under

Alternative 3, because of the nonlinear nature of the entrainment relationship (Table 3.4-11; see Appendix F). In all of the small fish entrainment examples, the increase in effect under Alternative 3 is more than double that of Alternative 2 because the number of existing agricultural diversions that are reduced remains the same; this results in relatively less “offsetting” of the doubled entrainment loss effects through screening of the agricultural diversions under Alternative 3. Therefore, the effects of Alternative 3 are more than twice those of Alternative 2 (Table 3.4-12).

The main increased benefit of Alternative 3 would be the doubled outflow to the Delta that would occur in fall of some years. This was not examined quantitatively but would be expected to push X2 farther downstream and result in a larger population of juvenile delta smelt the following summer, according to the relationship between fall X2 position and trawl abundance indices presented in Appendix F. The nonlinear nature of the relationship means that the increase in abundance would not be twice that of the project, which suggested an average increase of 1.2% (see section above entitled "Changes in Fish Population Abundance and Survival Caused by Shifts in X2").

WETLAND RESOURCES

The analysis methodology in this updated SEIS environmental analysis does not differ substantially from that used in the 2001 FEIS. Potential effects to wetlands and other waters of the U.S. were estimated based on existing wetland conditions (as documented in a verified delineation prepared by Environmental Science Associates in 2012) as compared with the location and operations of project components that would affect the extent or characteristics of jurisdictional features. The estimate of future (post-project) habitat conditions has been reevaluated and updated in this analysis through incorporation of the 2015 Draft CMP (Appendix B) and Conceptual Restoration Plans for each Habitat Island contained in Exhibits 1 and 2 of the CMP. These plans effectively update the earlier plans outlined in the 1995 Draft CMP and provide a framework for the establishment and preservation of compensatory wetlands and other waters of the U.S. for Alternatives 1 and 2 (Proposed Action). Therefore, the acreages of affected and predicted post-project habitats are different in the current analysis than those presented in the 2001 FEIS, because they account for the change in treatments of farmed wetland, and other slight changes in habitat classification and distribution as described previously under "New Circumstances and New Information."

Consistent with the 2001 FEIS methodology, a conservative estimate has been made for effects to wetlands and other waters of the U.S. on the Reservoir Islands. The Reservoir Islands would be operated based on water storage goals and it is assumed that although water levels would fluctuate seasonally, there would be limited wetlands present at any given time and their extent and characteristics are unpredictable. Therefore, habitat created through the operation of the Reservoir Islands is characterized as "seasonal open water" habitat, which is considered "other waters of the U.S." This analysis further assumes that all existing wetlands and other waters of the U.S. on the Reservoir Islands would be permanently converted to the seasonal open water habitat type under all but the No-Action Alternative.

3.4.5 ENVIRONMENTAL CONSEQUENCES AND MITIGATION MEASURES

SIGNIFICANCE CRITERIA

The basis for determining the significance of effects for this analysis is based on professional standards, project-specific criteria developed by the lead agency to address potential effects unique to the project's location and elements, and is informed by the criteria contained in the Environmental Checklist in Appendix G of the State CEQA Guidelines. These thresholds encompass the factors taken into account under NEPA to determine the significance of an action in terms of its context and the intensity of its effects. The Proposed Action or alternatives under consideration would have a significant, adverse effect on aquatic resources, including wetlands, if they would do any of the following:

- have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Wildlife or U.S. Fish and Wildlife Service;
- have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations or by the California Department of Fish and Wildlife or U.S. Fish and Wildlife Service;

- have a substantial adverse effect on Federally protected wetlands as defined by Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means (i.e., a reduction in the acreage or function and services of jurisdictional wetlands or other waters of the U.S.);

- interfere substantially with the movement, migratory corridors, or impede the use of nursery sites of any native resident or migratory fish; or

- conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan.

This analysis evaluates project effects on aquatic resources which include wetland habitats (jurisdictional features) and select Delta fish species that have ecological importance and/or are of management concern. As previously described, this includes the subset of fish species that support important sport and commercial fisheries; species that are unique to the Bay-Delta environment; species listed or being considered for listing under the Federal ESA and CESA; species with habitat protected under the Magnuson-Stevens Fishery Conservation and Management Act, as amended; and species that, when considered as a group, encompass the range of potential responses to the effects of project operations and facility construction. Effects to fish populations are considered adverse when project operations would cause or contribute to substantial short- or long-term reductions in abundance and distribution. A “substantial” reduction in a population varies by species; as such, there is no single definition that can be applied comprehensively. Each population has therefore been assessed individually for operations-related effects based on the methods summarized above under “Alternative 2 (Proposed Action) Operations and Delta Flow” and “Alternative 3 Operations and Delta Flow.” Due to the sensitive nature of the Delta ecosystem and the current declines in the abundance of many fish populations, a precautionary approach was adopted for this analysis in which even small predicted effects were regarded as adverse.

If the project would result in a net increase in the extent of wetlands or other waters of the U.S. and/or the function and services they provide, these are considered beneficial effects.

EFFECTS ANALYSIS

Effects on aquatic resources, including wetlands, resulting from implementing the project were described in the 2001 FEIS (Chapters 3F and 3G) and are listed below in Table 3.4-18. Where there have been no changes to the effects analysis or conclusions, the 2001 FEIS is herein incorporated by reference, and the effects conclusions and mitigation measures are briefly summarized.

No-Action Alternative

EFFECT AQR-1 **Alteration of Fish Habitat through Construction of Project Facilities.** *No new facilities would be constructed and no existing facilities would be altered or expanded in Delta waterways. Therefore, with implementation of the No-Action Alternative, there would be no construction-related effects to fish habitat in Delta waterways.*

Under the No-Action Alternative, no new facilities would be constructed and no existing facilities would be altered or expanded in Delta waterways adjacent to the project islands. Therefore, **no effects** to fish habitat from construction in Delta waterways would occur.

EFFECT AQR-2 **Operation-Related Increase in Organic Materials and Toxics and Decrease in Dissolved Oxygen of Delta Water from Project Discharges.** *There would be no discharges from the project islands related to water storage. However, adverse effects to special-status fish species would continue to be present in the form of increased discharge of agricultural drainage water from the project islands. Therefore, this effect is significant.*

Under the No-Action Alternative, there would be no discharges from the project islands related to water storage. However, adverse effects to special-status fish species would continue to occur and increase from intensified agricultural operations in the form of discharge of agricultural drainage water from the project islands. Pesticides, which are currently a component of agricultural discharge, would be expected to continue to be applied under the No-Action Alternative, but at higher rates on the Reservoir and Habitat Islands as compared to existing conditions. Therefore, discharges containing organic materials and toxins and a higher dissolved oxygen content under intensified agricultural operations could result in **significant** effects to special-status fish species.

EFFECT AQR-3 **Temperature-Related Effects on Chinook Salmon and Other Species from Project Operations.** *There would be no discharges from the project islands related to water storage. However, adverse effects to Chinook salmon and other fish species would occur in the form of increased discharge of agricultural drainage water from the project islands that may be warmer than the surrounding Delta waterways. Therefore, this effect is significant.*

Under the No-Action Alternative, there would be no discharges from water storage on the project islands. However, adverse effects to special-status fish species would continue to occur and would increase from intensified agricultural operations in the form of discharge of agricultural drainage water from the project islands, which could be warmer than receiving waters. Therefore, this effect is **significant**.

EFFECT AQR-4 **Potential Effects to Aquatic Life Resulting from an Increase in Accidental Spills of Fuel and Other Materials and Boat Wake Erosion During Project Operations.** *Under the No-Action Alternative, no new recreational facilities or maintenance boat docks would be constructed and there would be no new project-related boat activity that could result in an increase in accidental spills of fuel and other materials or boat wake erosion in Delta waterways adjacent to the project islands. Therefore, no effect would occur.*

Under the No-Action Alternative, no new recreational facilities or maintenance boat docks would be constructed and there would be no new related boat activity that could result in an increase in accidental spills of fuel and other materials or result in boat wake erosion in Delta waterways adjacent to the project islands. Thus, there would be **no effect**.

EFFECT AQR-5 **Effects on Juvenile Chinook Salmon from Project Diversions and Releases.** *The No-Action Alternative would not entail any diversions or releases related to water storage. Adverse effects to Chinook salmon would increase commensurate with the increase in unscreened agricultural diversions on the four project islands from intensified agricultural operations. Given the current status of Chinook salmon in the Central Valley and Delta, this effect is significant.*

Under the No-Action Alternative, there would be no diversions or releases related to water storage. However, adverse effects to Chinook salmon would increase commensurate with the increase in unscreened agricultural diversions on the four project islands from intensified agricultural operations, along with off-site water diversions and facilities effects including the SWP/CVP export facilities and numerous agricultural diversions. In addition, there is the potential for SWP/CVP operations to provide false outmigration cues to Chinook salmon juveniles traversing the Delta via the central Delta. False outmigration cues can lead to increases in direct entrainment and increased residence time within the central Delta (leading to a greater risk of predation, prolonged effects of poor water quality, and a greater possibility of entrainment at the south Delta pumps). Outmigrating juvenile Chinook salmon are the main life stage of this species likely to be affected in the Delta. The changing regulatory setting in the Delta region, specifically the incorporation of the Bay-Delta WQCP and full implementation of reasonable and prudent alternatives and measures in the USFWS and NMFS OCAP BOs will help to minimize entrainment effects at the SWP/CVP export facilities to Chinook salmon in the future. Nevertheless, given the current status of Chinook salmon in the Central Valley and Delta, the effect of increased project-related agricultural diversions on Chinook salmon is **significant**.

EFFECT AQR-6 Effects on Juvenile Steelhead from Project Diversions and Releases. *The No-Action Alternative would not entail any diversions or releases related to water storage. However, adverse effects to steelhead would increase commensurate with the increase in unscreened agricultural diversions on the four project islands from intensified agricultural operations. Given the current status of steelhead in the Central Valley and Delta, this effect is significant.*

Under the No-Action Alternative, there would be no diversions or releases related to water storage. However, adverse effects to steelhead would increase commensurate with the increase in unscreened agricultural diversions on the four project islands from intensified agricultural operations, along with off-site water diversions and facilities effects including the SWP/CVP export facilities and numerous agricultural diversions. In addition, there is the potential for SWP/CVP operations to provide false outmigration cues to steelhead juveniles traversing the Delta via the central Delta. False outmigration cues can lead to increases in direct entrainment and increased residence time within the central Delta (leading to a greater risk of predation, prolonged effects of poor water quality, and a greater possibility of entrainment at the south Delta pumps). Outmigrating juvenile steelhead are the main life stage of this species likely to be affected in the Delta. The changing regulatory setting in the Delta region, specifically the incorporation of the Bay-Delta WQCP and full implementation of reasonable and prudent alternatives and measures in the USFWS and NMFS OCAP BOs will help to minimize entrainment effects at the SWP/CVP export facilities to steelhead in the future. Nevertheless, given the current status of steelhead in the Central Valley and Delta, the effect of increased project-related agricultural diversions on steelhead is **significant**.

EFFECT AQR-7 Effects on Delta Smelt from Project Diversions and Releases. *The No-Action Alternative would not entail any diversions or releases related to water storage. However, adverse effects to delta smelt would increase commensurate with the increase in unscreened agricultural diversions on the four project islands from intensified agricultural operations. Given the current status of delta smelt in the Delta, this effect is significant.*

The No-Action Alternative would not entail any diversions or releases related to water storage. However, adverse effects to delta smelt would increase commensurate with the increase in unscreened agricultural diversions on the four project islands from intensified agricultural operations, along with off-site water diversions and facilities effects including the SWP/CVP export facilities and numerous agricultural diversions. Delta smelt are estuary-resident fish, inhabiting the Delta and other portions of the San Francisco Bay estuary throughout their lives. As a result, all life stages of delta smelt are present in the Delta and vulnerable to diversions and related effects including reverse flows, changes in turbidity, and changes in salinity. The changing regulatory setting in the Delta region, specifically the incorporation of the Bay-Delta WQCP and full implementation of reasonable and prudent alternatives and measures in the USFWS and NMFS OCAP BOs will help to minimize entrainment effects at the SWP/CVP export facilities to delta smelt in the future. Nevertheless, given the current status of delta smelt in the Delta, the effect of project-related agricultural diversions on delta smelt is **significant**.

EFFECT AQR-8 Effects on Longfin Smelt from Project Diversions and Releases. *The No-Action Alternative would not entail any diversions or releases related to water storage. However, adverse effects to longfin smelt would increase commensurate with the increase in unscreened agricultural diversions on the four project islands from intensified agricultural operations. Given the current status of longfin smelt in the Delta, this effect is significant.*

Under the No-Action Alternative, there would be no diversions or releases related to water storage. However, adverse effects to longfin smelt would increase commensurate with the increase in unscreened agricultural diversions on the four project islands from intensified agricultural operations, along with off-site water diversions and facilities effects including the SWP/CVP export facilities and numerous agricultural diversions. Longfin smelt, as with Delta smelt, are potentially present in the Delta during several stages of the life cycle. As a result, several life stages of longfin smelt are present in the Delta and vulnerable to diversions and related effects including reverse flows, changes in turbidity, and changes in salinity. The changing regulatory setting in the Delta region, specifically the incorporation of the Bay-Delta WQCP and full implementation of reasonable and prudent alternatives and measures in the USFWS and NMFS OCAP BOs will help to minimize entrainment effects at the SWP/CVP export facilities to longfin smelt in the future. Nevertheless, given the current status of delta smelt in the Delta, the effect of increased project-related agricultural diversions on longfin smelt is **significant**.

EFFECT AQR-9 — Effects on Green Sturgeon from Project Diversions and Releases. *The No-Action Alternative would not entail any diversions or releases related to water storage. However, adverse effects to green sturgeon would increase commensurate with the increase in unscreened agricultural diversions on the four project islands from intensified agricultural operations. Given the current status of green sturgeon in the Delta, this effect is significant.*

The No-Action Alternative would not entail any diversions or releases related to water storage. However, adverse effects to green sturgeon would increase commensurate with the increase in unscreened agricultural diversions on the four project islands from intensified agricultural operations, along with off-site water diversions and facilities effects including the SWP/CVP export facilities and numerous agricultural diversions. Juvenile green sturgeon are the main life stage of this species likely to be affected in the Delta. The changing regulatory setting in the Delta region, specifically the incorporation of the Bay-Delta WQCP and full implementation of reasonable and prudent alternatives and measures in the USFWS and NMFS OCAP BOs will help to minimize entrainment effects at the SWP/CVP export facilities to green sturgeon in the future. Nevertheless, given the current status of green sturgeon in the Delta, the effect of increased project-related agricultural diversions on green sturgeon is **significant**.

EFFECT AQR-10 — Effects on Other Aquatic Species from Project Diversions and Releases. *The No-Action Alternative would not entail any diversions or releases related to water storage that could affect common fish and invertebrate species inhabiting the Delta. However, adverse effects to these species would increase commensurate with the increase in unscreened agricultural diversions on the four project islands from intensified agricultural operations. Given the current common status of these species in the Delta, this effect is less than significant.*

Under the No-Action Alternative, there would be no diversions or releases related to water storage that could affect common fish and invertebrate species inhabiting the Delta. However, adverse effects to these species would increase commensurate with the increase in unscreened agricultural diversions on the four project islands from intensified agricultural operations, along with off-site water diversions and facilities effects including the SWP/CVP export facilities and numerous agricultural diversions. Given the prominence and broad distribution of these species, such as striped bass, white catfish, American shad, and threadfin shad in the Delta, current losses likely represent a relatively small portion of the total populations and are unlikely to constitute a substantial reduction in abundance or range. For native species that may occasionally inhabit the Delta (e.g., starry flounder), localized effects may occur, but the bulk of the population is likely to be far enough downstream that effects are minimal. Additionally, the changing regulatory setting in the Delta region, specifically the incorporation of the Bay-Delta WQCP and full implementation of reasonable and prudent alternatives and measures in the USFWS and NMFS OCAP BOs will help to minimize entrainment effects at the SWP/CVP export facilities to many of these species in the future. Therefore, the effect of increased project-related agricultural diversions on common fish and invertebrate species is **less than significant**.

EFFECT AQR-11 **Project Effects to Wetlands and Other Waters of the U.S. from Construction and Operation.** *The No-Action Alternative would not entail new construction or operation of reservoirs or Habitat Islands that could affect wetlands and other waters of the U.S. However, fallow, herbaceous upland, riparian, and wetland habitats would be converted to agricultural use commensurate with intensified agricultural operations. Therefore, adverse effects to wetlands and other waters of the U.S. would occur, and this effect is significant.*

With regard to existing wetland resources on the project islands, implementation of the No-Action Alternative would have an adverse effect on existing habitat types, primarily because intensified agricultural use would include the conversion of fallow, herbaceous upland, riparian, and wetland habitats to agricultural use. The 2001 FEIS indicated that the changes in vegetation types under the No-Action Alternative could result in a 50% decrease in riparian woodland and scrub (classified as wetlands), and a decrease in freshwater marsh of more than 80%, when compared to current conditions. Additionally, continuation of agricultural activities would allow the existing land subsidence processes to continue, leading to increased risk of levee failure and the associated potential for conversion and/or loss of wetland resources. Therefore, a **significant** effect to wetland resources on the project islands would occur.

EFFECT AQR-12 **Loss of Tidal Marsh and Tidal Channel Habitats from Project Construction and Operation.** *The No-Action Alternative would not entail new construction or operation of reservoirs or Habitat Islands that could cause the loss of tidal marsh and tidal channel habitats. Ongoing levee maintenance activities, however, would result in permanent loss of tidal marsh and Delta channel habitat occurring on the outside of the levees on the project islands. Therefore, this effect is significant.*

The No-Action Alternative would not entail new construction or operation of Reservoir or Habitat Islands that could affect tidal marsh and tidal channel habitats. Ongoing levee maintenance would continue, however, which would result in permanent adverse effects to (i.e., loss of) tidal marsh and Delta channel habitats outside of the levees on the project islands. Therefore, a **significant** effect to tidal marshes and tidal channel habitats would occur.

Alternative 1 and Alternative 2 (Proposed Action)

Under Alternative 1, the same amount of water would be diverted to the Reservoir Islands but less water would be discharged for export; this would result in lower entrainment effects and flow-related changes in the Delta as compared to Alternative 2. The water that is not exported would be released for outflow in fall (September–November), thereby increasing the water quality benefit compared to Alternative 2. Overall, the difference in effects to fishery resources between Alternatives 1 and 2 varies slightly by species because of seasonality and occurrence of species in regions that could be affected by the project. Overall, however, the effects analysis and mitigation measures for Alternatives 1 and 2 are substantially similar; therefore, they are described together under this heading.

EFFECT AQR-1 **Alteration of Fish Habitat through Construction of Project Facilities.** *Construction of proposed intake facilities and fish screens, discharge facilities, and maintenance boat docks could adversely change spawning and rearing habitat used by Delta fish species resulting in habitat loss. Therefore, this effect is significant.*

Construction of intake facilities and fish screens, discharge facilities, and maintenance boat docks could adversely change spawning and rearing habitat used by Delta fish species, resulting in habitat loss. Although specific spawning habitat parameters have not been defined for delta smelt, shallow vegetated habitat is believed to be important for their spawning success (U.S. Fish and Wildlife Service 1995). Historical and ongoing Federal, state, and local agency and private activities (e.g., dredging, placement of riprap, levee construction) have destroyed substantial areas of shallow vegetated habitat in the Delta, and recent downward trends in the population abundance of delta smelt may indicate the need to preserve the remaining habitat. If project intake sites or boat docks were located in or near shallow vegetated habitat, spawning habitat for delta smelt could be lost or altered. The habitat area lost would be small relative to the total area of similar habitat in the Delta, and such loss would have minimal effects on fish populations. However, loss of habitat could have a substantial adverse effect on localized reproduction of delta smelt. As discussed in the Environmental Commitments subsection above, the project would implement a SWPPP and associated BMPs specifically designed to control erosion, sediment, wind, waste management and materials pollution, and non-stormwater management that would help minimize adverse effects related to habitat alteration. The project also includes an environmental commitment to place a conservation easement on approximately 240 acres of brackish tidal wetlands on Chipps Island. However, given the reduced abundance of delta smelt and other species, loss of habitat could still occur and this loss would constitute a substantial reduction in habitat or range. Therefore, this effect is **significant**.

Mitigation Measure AQR-MM-1: Minimize Effects to Shallow-Water Vegetated Habitat and Replace Habitat Loss at a Ratio of 3:1.

The project applicant will design the project to minimize effects to shallow-water vegetated habitat. The project applicant will replace habitat lost due to construction of project facilities at a preservation ratio of 3:1. The acreage replaced will be determined based upon the final construction footprint acreage. The replacement will consist of the preservation of tidal habitat owned by the project applicant at Chipps Island, which will be placed into a conservation easement and preserved in perpetuity as an environmental commitment incorporated into the project.

Mitigation Measure AQR-MM-2: Site Project Facilities to Avoid Existing Shallow-Water Vegetated Habitat.

The project applicant will site project facilities at locations that avoid existing shallow-water vegetated habitat. The project applicant will retain a qualified botanist prior to final project design to conduct a survey of vegetation in shallow-water habitat, to help site facilities in locations that will minimize adverse effects to shallow-water vegetated habitat to the maximum extent practicable.

Mitigation Measure AQR-MM-3: Limit Waterside Construction to Less Sensitive Time Periods (August-October).

The project applicant will limit water side construction of the project to the August through October time period. This will minimize exposure of sensitive species such as delta smelt to the possible adverse effects of construction activities.

Implementation of Mitigation Measures AQR-MM-1, AQR-MM-2, and AQR-MM-3 would reduce the significant effects from construction-related alteration of fish habitat to a **less-than-significant** level because effects would be avoided and/or minimized where possible and the replacement of any lost habitat at a ratio of 3:1 would fully mitigate any habitat losses.

EFFECT AQR-2	Operation-Related Increase in Organic Materials and Toxics and Decrease in Dissolved Oxygen of Delta Water from Project Discharges. *Although the project's environmental commitments and FOC terms include project operating restrictions that preclude significant effects of the project on DO levels and avoid a substantial reduction in habitat for fish and other aquatic species, water discharged from Bacon Island may contain materials that would be toxic to aquatic organisms. Therefore, this effect is significant.*

Water discharged from the Reservoir Islands may have elevated levels of DOC but reduced quantities of particulate organic carbon (because of settling). Based on the water quality analysis contained in Section 3.12, "Hydrology and Water Quality," discharge of such additional material is not expected to have substantial adverse biological effects in the Delta and could increase availability of food for Delta fishes (see effect WQ-10 in Section 3.12). Section 3.12, "Hydrology and Water Quality," contains a detailed analysis of the potential effects of the project on Delta water quality. When filled, the project reservoirs would be relatively shallow (generally less than 20 feet deep), and water would be well mixed. It is assumed that DO levels in the reservoirs would be similar to those in the Delta channels. Algal blooms on the Reservoir Islands, however, may cause periodic differences between DO levels on the Reservoir Islands and in the Delta channels. Should this occur and the water be discharged, this effect may substantially reduce the available habitat for fish and other aquatic species. Discharge of water for export (July–November) or for outflow (i.e., beneficial use in October–November) that has lower DO levels could have adverse effects on salmonids that are sensitive to low levels of DO. However, water would be discharged at times of the year when the effects on salmonids would be minimal because the primary migration period is from December to June. The greatest potential for adverse effects from releases due to elevated water temperature is for late-fall-run Chinook salmon, of which the bulk of the population outmigrates in November and December. However, with implementation of the environmental commitments described above, project discharges would be prohibited from reducing DO levels in the receiving channel by more than 1 mg/l (see also Section 3.12, “Hydrology and Water Quality”). The FOC terms also include project operating restrictions that preclude significant effects of the project on DO levels and avoid a substantial reduction in habitat for fish and other aquatic species.

Pesticides, which are currently a component of agricultural discharges, would be applied at reduced levels on the Habitat Islands and would likely not be necessary on the Reservoir Islands. However, Effect 3.10-1 in Section 3.10, “Hazardous Waste and Materials” discusses the locations and types of potential contamination sites that have been identified on Bacon Island and Holland Tract. The identified sites on Bacon Island (one of the Reservoir Islands) consist of farm machinery repair facilities, pesticide storage areas, domestic waste dumps, and a copper salvaging site on Bacon Island. No potential contamination sites were identified on Webb Tract or Bouldin Island. Water storage on Bacon Island could mobilize soil contaminants from historical pollution sites. If the contaminant concentrations are high, mobilization of the dissolved fraction of the contaminants could cause an adverse effect on Delta channel water quality and, in turn, aquatic life and habitat, from discharged water. This effect is **significant**.

Mitigation Measure: Implement Mitigation Measure HZ-MM-1 (Conduct Assessments of Potential Contamination Sites and Remediate as Necessary).

Implementation of Mitigation Measure HZ-MM-1 would reduce this effect to a **less-than-significant** level because potential contamination sites would be identified and assessed. If contamination is likely to mobilize into the stored water, the project applicant would develop plans for site remediation. Such site assessments and remediation typically would be performed under the supervision of the Central Valley RWQCB. All required assessments and remediation would be completed prior to the beginning of project water storage.

EFFECT AQR-3 **Temperature-Related Effects on Chinook Salmon and Other Species from Project Operations.** *Project environmental commitments and FOC terms include operating restrictions that preclude significant effects of the project on temperature levels and would therefore avoid a substantial reduction in habitat for fish and other aquatic species. Thus, this effect is less than significant.*

Factors controlling the effect of project discharges on Delta channel water temperature consist of initial channel water temperature, temperature of the stored water on the Reservoir Islands at the time of discharge, volume of the discharge, volume of the receiving channel, flow and mixing in the receiving channel, and meteorological conditions. Delta channel water temperature depends primarily on meteorological conditions except during high river inflow periods. If the temperature on the project islands is substantially greater than water temperature in the adjacent Delta channels, project discharges could increase channel water temperature. Increased channel water temperature could affect survival, growth, reproduction, and movement of aquatic organisms, especially on salmonids. However, water would be discharged at times of the year when the effects on salmonids would be minimal because the primary migration period is from December to June.

The 1995 DEIR/EIS concluded that as a result of meteorological conditions, water temperature on the Reservoir Islands may be greater than water temperature in the adjacent Delta channels. It also concluded that the discharge of stored project water could increase channel water temperature and adversely affect the survival rates of juvenile Chinook salmon. If the altered channel water temperature exceeds 60°F (Kjelson et al. 1989), Chinook salmon survival could be substantially reduced. Temperatures greater than 60°F may also adversely affect growth. Releases of project water would occur in July–November (for export) and September–November (for outflow). The proportion of the juvenile population of all runs migrating during these periods varies but is typically very low. The proportion of the juvenile Chinook salmon population exposed to project discharges likely would be much less because most juvenile Chinook salmon do not migrate along the Old and Middle River (OMR) pathway (U.S. Fish and Wildlife Service 1987). Adult migration may be reduced at temperatures of 65–70°F (Boles 1988 as cited by National Marine Fisheries Service 2009:77; McCullough 1999 as cited by Lindley et al. 2004:4). Some of the releases during the July-November period would go to export. Migrations at this time consist primarily of spring-run and fall-run Chinook salmon and steelhead (Williams 2006). The September–November discharge-for-outflow period overlaps primarily with the upstream migrations of fall-run Chinook salmon and steelhead. The discharge of higher temperature water from project islands could substantially restrict the range of salmonids migrating through the Delta, both as juveniles and adults, and could substantially reduce the abundance of juvenile Chinook salmon if the temperature of discharged water is not monitored and controlled. Discharge of water for export (July–November) or for outflow (i.e., beneficial use in October–November) could potentially affect fish due to the elevated temperature and reduced DO of reservoir water relative to the receiving Delta waters. However, as discussed previously in the "Environmental Commitments" subsection above, the project includes a temperature assessment and regulation program that is specifically designed to avoid a substantial reduction in habitat for fish and other aquatic species. Therefore, this effect is **less than significant**.

Mitigation Measure: No mitigation is required.

EFFECT AQR-4 **Potential Effects to Aquatic Life Resulting from an Increase in Accidental Spills of Fuel and Other Materials and Boat Wake Erosion During Project Operations.** *Construction and operation of the proposed water storage facilities would result in only minor increases in boat traffic. These increases would not result in substantial new effects to aquatic life related to accidental fuel and oil spills from boat wake erosion. Therefore, this effect is less than significant.*

The project does not include construction of recreational facilities. As discussed in Section 3.17, "Traffic and Transportation" (Table 3.17-3), construction of the proposed water storage facilities would result in 36 daily additional boat trips during the construction period. Project operation would generate12 daily boat trips. This small number of increased boat trips during the project's construction and operational phases would not result in substantial effects from accidental spills of fuel and lubricants and would not substantially increase boat wake erosion. Thus, project-related boating activities would have a **less-than-significant** effect on sensitive Delta fish species.

Mitigation Measure: No mitigation is required.

EFFECT AQR-5 **Effects on Juvenile Chinook Salmon from Diversions and Releases.** *Project operations would result in small increases in entrainment during certain periods and these fish may represent an important loss to the population in terms of genetically fitter individuals. Therefore, this effect is significant.*

Outmigrating juvenile Chinook salmon are the main life stage of this species likely to be affected by the project. The potential effects include entrainment during diversions to the project islands and, to a lesser extent, during discharges of project water for export. Other effects include possible exposure to reduced water quality (as addressed above in effects AQR-2 and AQR-3) during discharge of project water. The average entrainment loss to the project diversions under Alternative 2 was estimated to range from 0.0% of the baseline SWP/CVP loss for spring-run Chinook salmon (which were present only at very low density during the December–March diversion period) to 0.2% of baseline for winter-run and late fall–run Chinook salmon (which are most abundant during the December–March diversion period). The proposed reduction and screening of existing project agricultural diversions would offset the project losses for fall-run and spring-run Chinook salmon, but not for winter-run or late fall-run Chinook salmon because the main migration periods of the former two species overlap the main diversion period to a lesser extent than those of the latter two species. Given that the installed screens would be constructed to delta smelt standards, which are above those required for salmonids (i.e., approach velocity is lower), it is probable that the screened intakes would entrain very few salmonids (National Marine Fisheries Service 2009). Effects to fall-run and late fall-run Chinook salmon would be slightly less under Alternative 1 than Alternative 2 due to a minor decrease in SWP entrainment and migration mortality as a result of decreased exports of project water. For late fall-run Chinook salmon, over 30% of the juveniles are assumed to outmigrate in July-November, so the reduction in effect would be moderate, while only 2% of the fall-run juveniles outmigrate during this time period resulting in only a minor reduction in effect.

The conservation easement on Chipps Island included primarily as a benefit for delta and longfin smelt (see the “Environmental Commitments” subsection above) would also benefit other species. The importance of estuarine habitats for salmonids was not, until recently, examined in detail. Survival of juvenile Chinook salmon to adulthood is enhanced in watersheds that have a greater proportion of natural estuarine habitat (Magnusson and Hilborn 2003). Chipps Island is an estuarine area that is included in critical habitat designations for winter-run and spring-run Chinook salmon. Along with other areas in Suisun Bay/Marsh, seasonal restrictions on water diversions are implemented to protect these two species (and delta smelt). Perpetual conservation of 240 acres of Chipps Island would enhance salmonid survival. The position of Chipps Island, at a prominent location on the outmigration route, is likely to be of considerable importance to juvenile salmonids.

There is the potential for project diversions to provide false outmigration cues to Chinook salmon juveniles traversing the Delta via the central Delta. Through direct entrainment and increased residence time within the central Delta (leading to a greater risk of predation, prolonged effects of poor water quality, and a greater possibility of entrainment at the south Delta pumps), the project was estimated to result in average mortality of 0.12% of winter-run Chinook salmon juveniles and 0.01% of spring-run Chinook salmon. The losses may be relatively small in numeric terms, but NMFS (2009) notes that the loss of individuals that have successfully survived many earlier threats prior to entry to the Delta may represent a significant loss to the population in terms of genetically fitter individuals; this may represent a substantial reduction in abundance of Endangered winter-run Chinook salmon and Threatened spring-run Chinook salmon. Therefore, this effect is **significant**.

Mitigation Measure: Implement Mitigation Measure AQR-MM-1 (Minimize Effects to Shallow-Water Vegetated Habitat and Replace Habitat Loss at a Ratio of 3:1).

Mitigation Measure AQR-MM-4: Implement a Fishery Improvement Mitigation Fund.

The project applicant will implement a fishery improvement mitigation fund that will provide monetary compensation to support habitat enhancement and conservation of fish populations. Annual fund contributions would be based on the annual quantity of water diverted to the Reservoir Islands, the amount of this water exported, and project effects. Previously, DFW and NMFS imposed permit terms that called for between $750-1,250/thousand acre-feet (TAF) for diversions during October through August and $2,250/TAF for export discharges. Revised permit terms may be established by USFWS, DFW, and NMFS. Initial funding will be provided by the project applicant prior to implementing the project.

Use of the monies from the fund will be at the discretion of the resource agencies that would implement actions to improve habitat conditions and decrease mortality for species affected by the project; it is expected that money from the fund will be contributed to several of the following improvement actions:

- **Augmenting spawning and rearing habitat for salmonids in tributaries of the Central Valley.** For example, funding could be provided toward the Battle Creek Salmon and Steelhead Restoration Project implemented by DWR, Reclamation, USFWS, DFW, and NMFS.

- **Restoring habitat within the Delta.** There are opportunities to contribute funds to the Delta Pumping Plant Fish Protection Agreement (i.e., Four Pumps Agreement), which calls for cost-sharing and has successfully conducted restoration projects, installed screens and barriers, and increased enforcement in the Delta.

- **Rearing and releasing additional fish.** There is an opportunity to contribute to the U.C. Davis/ USFWS Fish Conservation and Culture Facility that is currently rearing delta smelt as a safeguard against further declines in the wild population but requires additional facilities to maintain sufficient family groups to maintain genetic diversity.

- **Improving fish salvage operations.** There is an opportunity to contribute to DWR and Reclamation's efforts to improve salvage techniques at the SWP and CVP fish facilities in accordance with the 2009 NMFS OCAP BO.

Implementation of the environmental commitment to place a conservation easement that would protect approximately 240 acres of tidal wetlands on Chipps Island, and implementation of Mitigation Measures AQR-MM-1 and AQR-MM-5 would reduce this effect, but not to a less-than-significant level because the loss of individuals may represent a substantial loss to the overall population in terms of genetically fitter individuals that have survived passage to the Delta and may substantially reduce the abundance of this species. There are no additional feasible mitigation measures available to fully reduce this adverse effect to a less-than-significant level. Therefore, this effect is **significant and unavoidable**.

EFFECT AQR-6 Effects on Juvenile Steelhead from Diversions and Releases. *Project operations would result in small increases in entrainment during certain periods, and these fish may represent an important loss to the population in terms of genetically fitter individuals. Therefore, this effect is significant.*

All potential project effects identified for Chinook salmon could also occur to steelhead: changes in water quality due to project discharges; entrainment at project diversions and, to a lesser extent, entrainment during export of discharged project water; and increased Delta mortality because of altered hydrodynamics or false outmigration cues caused by project diversions. Changes in water quality would be minimized by the environmental commitments detailed above and in Chapter 2, "Project Description and Alternatives."
For Alternative 2, the net entrainment loss was estimated to average 0.1% of the baseline loss attributable to SWP/CVP exports. Nobriga and Cadrett (2001) estimated that between 0.04% and 0.5% of all Central Valley steelhead smolts (wild and hatchery-origin) were salvaged at SWP and CVP fish facilities from 1997 to 2000. Assuming around four times as many fish were lost before salvage, this would give an upper limit of 2% of smolts lost. Estimates of the total number of steelhead smolts at that time ranged from 1.8 million in 1997–1998 to almost 2 million in 1998–1999. Assuming loss of steelhead to project diversions or discharges for export is 0.1% of baseline SWP/CVP losses, 0.1% × 2% × 2 million = 40 steelhead smolts that could have been lost to the project diversions. This is close to the estimated 28 steelhead estimated to be lost during project diversions and south Delta export of project water. The proportion of the loss that would be made up of wild-origin individuals may be around 30% (Nobriga and Cadrett 2001).

The overall loss of steelhead smolts entering the Delta from the Sacramento River that might be attributable to project operations under Alternative 2 (direct entrainment plus increased predation loss plus increased exposure to poor water quality plus increased probability of entrainment at SWP/CVP) was estimated at approximately 0.7%. This would represent around 14,000 smolts (hatchery- and wild-origin) based on the upper population estimate above. Relative effects on steelhead under Alternative 1 would be slightly less as compared to Alternative 2 in terms of the level of estimated operations-related mortality that could occur. Levels of entrainment at the project diversions would be unchanged, but there would be a minor decrease in migration mortality due to project diversions and entrainment mortality at SWP during the export of project water. An estimated 1% of the juveniles are assumed to outmigrate during the time frame when water is discharged for export (July–November) therefore resulting in a minimal reduction in effect. Estuarine areas are also important critical habitat for steelhead (National Marine Fisheries Service 2009:113); therefore, the species would benefit from the project's environmental commitment to establish a perpetual shallow-water conservation easement at Chipps Island. However, as noted for Chinook salmon above, the loss of steelhead individuals may represent a substantial loss to the population in terms of genetically fitter individuals that have survived passage to the Delta and may substantially reduce the abundance of this species. Therefore, this effect is **significant**.

Mitigation Measure: Implement Mitigation Measure AQR-MM-1 (Minimize Effects to Shallow-Water Vegetated Habitat and Replace Habitat Loss at a Ratio of 3:1).

Mitigation Measure: Implement Mitigation Measure AQR-MM-4 (Implement a Fishery Improvement Mitigation Fund).

Implementation of the various environmental commitments detailed above and implementation of Mitigation Measures AQR-MM-1 and AQR-MM-5 would reduce this effect, but not to a less-than-significant level because the loss of individuals may represent a substantial loss to the overall population in terms of genetically fitter individuals that have survived passage to the Delta and may substantially reduce the abundance of this species. There are no additional feasible mitigation measures available to fully reduce this adverse effect to a less-than-significant level. Therefore, this effect is **significant and unavoidable**.

EFFECT AQR-7 Effects on Delta Smelt from Diversions and Releases. *Project operations would result in small increases in entrainment during certain periods; however, given the long-term downward trend in abundance of delta smelt, this effect is significant.*

Delta smelt are estuary-resident fish, inhabiting the Delta and other portions of the San Francisco Bay estuary throughout their lives. Thus, several life stages may be affected by the project (see Table 3.4-13). The loss of habitat during construction could affect the number of eggs successfully spawned as described earlier. The effects of entrainment loss under Alternative 2 are marginally counteracted by the average gain in optimal salinity area, resulting in an average loss of 0.14% of all larvae. Assuming that 0.25% of larvae survive to adulthood (Bennett 2005), the loss of larvae could represent a loss of 0.00005% of the adult population. During the juvenile phase, net entrainment loss under Alternative 2 averaged 1.2% of baseline SWP/CVP mortality and occurred during discharges for export. If project diversions decrease OMR flows, then an average of 0.24% of juveniles may be entrained at the export facilities each year. Releases of water in September–November may increase the following summer's juvenile population by outflow- or salinity-related mechanisms correlated with decreased (downstream) X2 that benefit the older juvenile (subadult) population in fall.

Assuming that SWP/CVP exports cause the loss of 15% of the adult population annually (Kimmerer 2008), the project (under Alternative 2) may take an additional 0.1% × 15% = 0.015% of the adult population during diversions to the Reservoir Islands. Under the worst-case scenario, the diversions to the Reservoir Islands could cause entrainment of adult delta smelt at the export facilities due to decreased OMR flows—this averaged 0.70% of the adult population in the analysis. Adding all "equivalent adult" losses suffered by the population at the various life-history stages, the estimated average annual loss attributable to the project is around 0.72% of the adult population. Under Alternative 1, effects to adult delta smelt would be unchanged while potential effects to larvae and juvenile delta smelt would be slightly decreased (but still significant). This change would result from lower levels of SWP entrainment due to lower levels of exported project water as well as greater summer abundance because of increased fall discharges that provide more habitat for subadults. Additionally, there would be lower levels of summer entrainment of smelt zooplankton prey species (*P. forbesi*), thus further benefiting the population.

Table 3.4-13 Summary of Key Project Effects on Delta Smelt under Alternative 2 (Proposed Action) (Percentages Represent Averages over the Time Periods Included in Each Analysis)				
Life Stage	Analysis	Average Effect	Percentage Surviving to Adulthood[1]	Percentage of Adult Population
Eggs	Loss of spawning habitat (analysis from 1995 DEIR/EIS)	Qualitative—could occur if suitable habitat is lost	0.067	N/A
Larvae	Entrainment loss during DW diversions	0.2% loss	0.25	0.0005
	Optimal salinity area	0.09% gain	N/A	0.00000225
Juveniles	Entrainment loss during export of project water	1.2% loss (compared to baseline SWP/CVP)	1	0.0016[2]
	Entrainment loss due to OMR flow effect	0.24%	N/A	0.0024
	Zooplankton prey loss	1.2% loss	N/A	0.012
	Population abundance-X2 analysis	1.2% gain	N/A	0.012
Adults	Entrainment loss during project diversions	0.1% loss (compared to baseline SWP/CVP)	100	1. 0.015[3]
	Entrainment loss due to OMR flow effect	0.70%	N/A	2. 0.70

Notes: SWP = State Water Project; CVP = Central Valley Project; N/A = not applicable or data not available

1 Values assumed from Bennett's (2005:12) conceptual delta smelt life-history model.

2 Assumes that baseline annual SWP/CVP loss is 13% of total juveniles, the median of the values calculated by Kimmerer (2008).

3 Assumes that baseline annual SWP/CVP loss is 15% of total adults, the median of the values calculated by Kimmerer (2008).

Source: ICF 2010:4.5-95; adapted by Environmental Science Associates in 2013

Spring Kodiak trawl data were extrapolated to calculate an average adult delta smelt population size from 2002 to 2008 of approximately 900,000 individuals, which is consistent with estimates presented by Kimmerer (2008:21). The loss attributable to the project under Alternative 2 may represent around 6,500 adult delta smelt. Given the long-term downward trend in abundance of delta smelt, the additive effects of the project may substantially reduce the abundance of this listed species. Therefore, this effect is **significant**.

Mitigation Measure: Implement Mitigation Measure AQR-MM-1 (Minimize Effects to Shallow-Water Vegetated Habitat and Replace Habitat Loss at a Ratio of 3:1).

Mitigation Measure: Implement Mitigation Measure AQR-MM-4 (Implement a Fishery Improvement Mitigation Fund).

Implementation of the environmental commitment to place a conservation easement on approximately 240 acres at Chipps Island and implementation of Mitigation Measures AQR-MM-1 and AQR-MM-4 would reduce this effect, but not to a less-than-significant level because of the current low abundance of delta smelt and the uncertainty associated with the effectiveness of the proposed mitigation. There are no additional feasible mitigation measures available to fully reduce this adverse effect to a less-than-significant level. Therefore, this effect is **significant and unavoidable**.

EFFECT AQR-8 Effects on Longfin Smelt from Diversions and Releases. *Project operations would result in small increases in entrainment during certain periods, and given the long-term downward trend in abundance of longfin smelt, this effect is significant.*

Longfin smelt, as with delta smelt, may be affected by the project at several stages of their life cycle. Increased entrainment loss of juveniles during export of discharged project water under Alternative 2 was 0.2% of baseline SWP/CVP (accounting for reduced project agricultural loss due to reductions and screening); loss of subadults during the project diversions in December–March would be very low (0.0% of baseline SWP/CVP export loss, or 10 fish per year on average). It is unclear to what extent spawning habitat may be lost or what proportion of total spawning habitat could be affected by the project. Applying a framework of estimating losses in terms of equivalent older life stages, in this case subadults (i.e., longfin smelt nearing the end of their first year of life), suggests that effects on larvae because of entrainment loss and reduction of optimal salinity area could represent an average annual loss of 0.00075% of the subadult population (see Table 3.4-14).

Table 3.4-14
Summary of Project Effects on Longfin Smelt under Alternative 2 (Proposed Action)

Life Stage	Analysis	Average Effect	Percentage Surviving to Subadulthood[1]	Percentage of Subadult Population
Eggs	Loss of spawning habitat (analysis from 1995 DEIR/EIS)	Qualitative—could occur if suitable habitat is lost	0.01	
Larvae	Entrainment loss during project diversions	0.1% loss	0.25	0.00025
	Optimal salinity area	0.2% loss	N/A	0.0005
Juveniles	Entrainment loss during export of project water	0.2% loss (compared to baseline SWP/CVP)	1	0.0002[2]
Subadults	Population abundance–X2 analysis	1% loss	100	1
	Entrainment loss during project diversions	0.0% loss (compared to baseline SWP/CVP)	N/A	N/A

Notes: SWP = State Water Project; CVP = Central Valley Project; N/A = not applicable or data not available

1 Values assumed from Bennett's (2005:12) conceptual delta smelt life-history model, with fecundity changed to 10,000 eggs per female.

2 Assumes 10% of the juvenile population is lost due to baseline entrainment at SWP/CVP export facilities.

Source: ICF 2010:4.5-97; adapted by Environmental Science Associates in 2013

The greatest potential effect on the longfin smelt population is estimated to be caused by diversions during January to June, which may result in an average decrease in subadult population abundance (indexed by the FMWT survey). Assuming the FMWT index represents overall population trends of longfin smelt in the region sampled by the FMWT, the project on average would result in a reduction of the population's abundance by about 1%. Kimmerer et al. (2009) suggested that a portion of the correlation between X2 and longfin smelt could be explained by changes in habitat availability (e.g., the reduction in optimal salinity habitat area), but that other factors such as larval retention may increase with decreasing X2 (i.e., increasing inflow). In isolation, a 1% reduction in population is not likely to represent a substantial reduction in abundance or to pose a threat to eliminate the species from the region. Nevertheless, the species' long-term abundance decline and apparent reduced survival following the 1987–94 drought (Rosenfield and Baxter 2007) mean that even a small decline in population could constitute a substantial reduction in the population's ability to sustain itself. The estimated population size of longfin smelt within the FMWT survey area averaged 1,330,000 from 1993 to 2007 (California Department of Fish and Wildlife 2009a). The proportion of subadults (fish up to 1 year old) in the FMWT is about 90%, with the rest being mostly adults up to 2 years old (California Department of Fish and Wildlife 2009a; Rosenfield and Baxter 2007). This estimate is based on volumetric extrapolations of catch-per-unit volume and does not include regions seaward of the FMWT survey area, which many longfin smelt inhabit. The average annual loss of longfin smelt subadults in the FMWT area attributable to the project water diversions under Alternative 2 during the early-life period is estimated at around 1,300 fish. Project effects to longfin smelt under Alternative 1 would be slightly different than Alternative 2. Due to the difference in project export timing (July–

November) there would only be approximately 1% of the total population present in the project vicinity and there would be a slight decrease in SWP entrainment due to decreased exports of project water. Given the species' recent decline, this may constitute a substantial reduction in abundance and is possibly caused by a marked reduction in favorable early-life habitat; therefore, this effect is **significant**.

Mitigation Measure: Implement Mitigation Measure AQR-MM-1 (Minimize Effects to Shallow-Water Vegetated Habitat and Replace Habitat Loss at a Ratio of 3:1).

Mitigation Measure: Implement Mitigation Measure AQR-MM-4 (Implement a Fishery Improvement Mitigation Fund).

Implementation of the above environmental commitments (i.e., water quality standards, spill prevention, reduction in boat wake erosion, and reductions in diversion/discharge during smelt presence) and implementing Mitigation Measures AQR-MM-1 and AQR-MM-4 would reduce this effect. Implementing placement of a conservation easement on approximately 240 acres at Chipps Island as an environmental commitment would reduce the average loss of optimal salinity habitat (0.26 km^2 [64.2] acres per year), although it should be noted that the maximum loss was projected to be 5.74 km^2 (around 1,400 acres). Although the environmental commitments and mitigation measures listed above would reduce the project's effect on longfin smelt, the effect would not be reduced to a less-than-significant level due to the uncertainty associated with implementation of these mitigation measures. There are no additional feasible mitigation measures available to fully reduce this adverse effect to a less-than-significant level. Therefore, this effect is **significant and unavoidable**.

EFFECT AQR-9 — Effects on Green Sturgeon from Diversions and Releases. *Project operations would result in small increases in entrainment during certain periods, and given that these losses could be important to the overall abundance of green sturgeon, this effect is considered significant.*

NMFS (2009:131) notes that good water quality is important for green sturgeon. Discharges of project water could affect juvenile sturgeon and restrict their distribution, although the project's environmental commitments to maintain adequate water quality standards minimize this effect. Juvenile green sturgeon may be entrained at the SWP/CVP pumping facilities during export of discharged project water. For Alternative 2, the average annual net increase in loss was 2.6% of baseline SWP/CVP losses; this amounted to five green sturgeon based on the extrapolation of observed salvage density that was used to derive the density of green sturgeon in the Delta. Effects to green sturgeon under Alternative 1 would be slightly less than those under Alternative 2. The reduction in effects would be due to a decrease in SWP entrainment because of decreased exports of project water. Although the estimated average loss appears small and the maximum loss was estimated at 19, this could be an important effect on the abundance of the population, therefore this effect is **significant**.

Mitigation Measure: Implement Mitigation Measure AQR-MM-4 (Implement a Fishery Improvement Mitigation Fund).

Implementation of the project's environmental commitments detailed above and implementation of Mitigation Measure AQR-MM-4 would reduce the effect of the project on green sturgeon, but not to a less-than-significant level because the declining population abundance may make even a small loss substantial and reduce the population towards levels that are no longer self-sustaining. There are no additional feasible mitigation measures available to fully reduce this adverse effect to a less-than-significant level. Therefore, this effect is **significant and unavoidable.**

EFFECT AQR-10 — Effects on Other Aquatic Species from Diversions and Releases. *Project operations would result in small increases in entrainment during certain periods. However, no substantial reduction in abundance, range, or habitat for any other species is anticipated. Therefore, this effect is less than significant.*

The project may affect many common fish and invertebrate species inhabiting regions of the Delta and downstream that may be influenced by project operations. Entrainment during project diversions or discharges for export was estimated to increase losses by around 3.7–4.5% of baseline SWP/CVP salvage for three species analyzed in the juvenile and adult fish entrainment analysis (white catfish, American shad, and threadfin shad). Assuming that diversions to the Reservoir Islands occurs in December–March and that discharge for export occurs in July–November, loss of striped bass eggs would not occur during project operations. The area of optimal salinity habitat decreased by an average of 0.11% for striped bass larvae. Losses of zooplankton, as analyzed for delta smelt, probably would affect other species. Effects to common fishes and invertebrates under Alternative 1 would be slightly less than those under Alternative 2. This reduction in effects would be due to a decrease in SWP entrainment because of decreased exports of project water.

The prominence and broad distribution of nonnative species such as striped bass, white catfish, American shad, and threadfin shad in the Delta mean that they may have appreciable numeric losses attributable to the project. However, the losses likely represent only a small portion of the total populations and would be unlikely to constitute a substantial reduction in abundance or range. For native species that may occasionally inhabit the Delta (e.g., starry flounder), localized effects may occur, but the bulk of the population is likely to be far enough downstream that effects of project operations would be minimal. No substantial reduction in abundance, range, or habitat for any other species is anticipated. Therefore, this effect is **less than significant**.

Mitigation Measure: No mitigation is required.

EFFECT AQR-11 **Effects to Wetlands and Other Waters of the U.S. from Construction and Operation.** *Excluding the approximately 10,798 acres of seasonal open water habitat type that would be created with the construction of the Reservoir Islands, implementation of Alternatives 1 and 2 would result in a net increase of approximately 1,033 acres of wetlands and 102.8 acres of other waters of the U.S. Therefore, this effect is less than significant and beneficial.*

Invasive Species

With respect to invasive species, the project would not include elements or sources of water that would introduce invasive species. Delta water would be used to flood the Reservoir Islands and irrigate the Habitat Islands. As a result, project operations would not affect the type or amount of invasive species in the Delta.

Within the Delta, benthic macroinvertebrates typically live within the top 12 inches of sediment, while epibenthic macroinvertebrates typically live on the sediment surface. Within Suisun Bay, and the western and central Delta, benthic and epibenthic species include bay shrimp, opossum shrimp, amphipods, polychaetes, oligochaetes, and clams. The nonnative Asian clam (*Corbicula fluminea*) has rapidly expanded its geographic distribution and abundance within Suisun Bay and the central Delta (Thompson and Peterson 1998) and has achieved sufficiently high population abundance that feeding (clams are filter feeders) has substantially altered the abundance of phytoplankton and zooplankton within the estuary.

Characteristics of the benthic and epibenthic macroinvertebrate community are influenced by a variety of physical and water quality conditions that occur within the Delta, the most important being flow velocities, substrate characteristics, and salinity gradients (Thompson et al. 2000). As stated in Herbold et al. (1992), the factors most affecting the abundance, composition, and health of the benthic community from year to year are outflow from the Delta, local runoff, and pollution (Nichols and Pamatmat 1988). Lower outflows tend to be associated with lower phytoplankton biomass and hence lower productivity during periods of low flow. High outflows lead to lower salinities, which particularly control the species abundance and composition in shallow areas where animals are exposed to less saline surface water.

Benthic communities in the Bay-Delta estuary have also been influenced by disturbances such as dredging and filling activities. Sediment grain-size distributions show that sandy sediments persist in areas of high current velocities such as the channel areas (Rubin and McCulloch 1979), while finer sediments settle in areas of lower current velocity such as in the shoals and small channels (Krone 1979) and in the shallow open water habitat in flooded islands such as Franks Tract. Benthic and epibenthic invertebrate populations are generally most abundant in areas having reduced water velocities, fine-grained sediments, and relatively stable benthic environments (little sediment resuspension, movement or disturbance, slow rates of accretion or depletion of sediments). In deeper water channel, and high velocity areas characterized by sand and coarse substrate with substantial daily, seasonal or interannual substrate movement and accretions and depletions, benthic and epibenthic macroinvertebrate communities characteristically have reduced species diversity and abundance.

Many of the more common benthic species that inhabit the estuary are not native to the region but have been transported and introduced into the estuary through the discharge of ballast water from commercial ships, or on the shells of oysters brought from the East Coast for commercial farming in the late 19th century (Carlton 1979). Over 40% of the individuals comprising the benthic community in a given area of the estuary can be nonindigenous species (Carlton 1979; Cohen 2000). Many of these introduced species may serve ecological functions similar to native species that they may have displaced; however, some species may be detrimental to the aquatic ecosystem of the estuary. All but two of the benthic mollusks (i.e., oysters and clams) are introduced. Within the vicinity of Franks Tract, one of the dominant mollusks, the Asian clam, is intolerant of saline waters.

The project has the potential to result in effects to the benthic invertebrate community, including invasive clams, during construction, including the installation of diversion and discharge facilities. These effects would be temporary and relatively small. In addition, since the reservoirs are seasonal, it will be difficult for invasives to flourish above current population levels since their lifecycle would be interrupted because their aquatic habitat would be removed every year. Therefore, while some non-native benthic species may persist in areas of the reservoirs once drained, the population levels of these non-native benthic species are not expected increase over current levels.

Over the long term, the project could continue to result in relatively small, localized effects from the discharge of water from the Reservoir Islands and associated scour. It is anticipated that these effects would be very small, potentially indiscernible as it relates to aquatic invasive species and associated effects to native fish due to the temporary and localized nature of the discharge operations and because the discharge facilities are located in deeper water channel, and high velocity areas characterized by sand and coarse substrate with substantial daily, seasonal or interannual substrate movement and accretions and depletions, where benthic and epibenthic macroinvertebrate communities characteristically have reduced species diversity and abundance. Therefore, this effect is **less than significant**.

Mitigation Measure: No mitigation is required.

Loss or Conversion of Wetlands and other Waters

Alternatives 1 and 2 would result in the loss or conversion of approximately 2,861.4 acres of wetlands and other waters of the U.S., including 2,195.4 acres of farmed wetlands, 287.5 acres of freshwater marsh, 121 acres of cottonwood-willow, 102.1 acres of Great Valley willow scrub, 0.9 acre of tidal marsh, 64.6 acres of canals and ditches, and 83.5 acres of permanent ponds, and 6.4 acres of tidal channels (see Table 3.4-15). As shown in Table 3.4-16, on the Reservoir Islands, these effects would occur as the result of the expansion of perimeter levees on the interior of the islands; construction of new intakes, outfalls, and boat docks; and interior grading and the filling of the islands during operations (inundation). On the Habitat Islands, approximately 688.5 acres of farmed wetlands would be converted to other wetland types (primarily freshwater marsh). Effects to freshwater marsh, Great Valley willow scrub, and canals/ditches on the Habitat Islands would occur as a result of constructing various infrastructure improvements, including roadways and building pads for maintenance structures.

Table 3.4-15
Effects to Wetlands and Other Waters of the U.S. under Alternatives 1 and 2 (Proposed Action) on all Project Islands

Affected Habitat Acreage							
	Reservoir Islands[1]			Habitat Islands[2]			
Wetland Type	Bacon Island	Webb Tract	Total	Bouldin Island	Holland Tract	Total	Total Affected (All Islands)
Farmed Wetlands	406.5	1,100.5	1,506.9	71.9	616.6	688.5	**2,195.4**
Freshwater Marsh	116.9	159.0	275.9	3.3	8.4	11.6	**287.5**
Seasonal Wetlands	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
Cottonwood-Willow	8.8	112.2	121.0	0.0	0.0	0.0	**121.0**
Great Valley Willow Scrub	9.2	91.7	100.9	0.0	1.2	1.2	**102.1**
Tidal Marsh	0.8	0.2	0.9	0.0	0.0	0.0	**0.9**
Total Wetlands	**542.1**	**1,463.5**	**2,005.6**	**75.2**	**626.1**	**701.3**	**2,706.9**
Canals/Ditches	27.2	33.6	60.8	3.8	0.0	3.8	**64.6**
Permanent Ponds	0.2	83.3	83.5	0.0	0.0	0.0	**83.5**
Tidal Channel	3.1	3.2	6.4	0.0	0.0	0.0	**6.4**
Total Other Waters	**30.6**	**120.1**	**150.7**	**3.8**	0.0	0.0	**154.5**
Total Wetlands and Other Waters	**572.7**	**1,583.6**	**2,156.3**	**79**	**626.1**	**705.1**	**2,861.4**

Notes:

[1] See Table 3.4-16, for a detailed breakdown of wetland effects by project activity for the Reservoir Islands.

[2] Effects to wetlands on the Habitat Islands consist of type conversion (farmed wetlands converted to other wetland types, primarily freshwater marsh) and fill due to the construction of maintenance facilities (including roadways and maintenance pads).

Source: Environmental Science Associates 2013

Table 3.4-16
Wetland Effects by Activity on the Reservoir Islands under Alternative 1 and Alternative 2 (Proposed Action)

	Project Activity								
	Webb Tract				Bacon Island				Total Reservoir Islands
	Levee Expansion[1]	Inundation	Attendant Facilities[2]	Total	Levee Expansion[1]	Inundation	Attendant Facilities[2]	Total	
Wetlands									
Farmed Wetland	11.29	1,089.17	0.00	1,100.46	3.38	403.09	0.00	406.47	**1,506.9**
Freshwater Marsh	5.86	153.11	0.00	158.97	8.09	108.82	0.00	116.91	**275.9**
Forested Wetland	21.09	182.83	0.00	203.92	0.00	17.99	0.00	17.99	**221.9**
Tidal Marsh	0.00	0.00	0.15	0.15	0.00	0.00	0.76	0.76	**0.9**
Subtotal	**38.24**	**1,425.11**	**0.15**	**1,463.50**	**11.47**	**529.90**	**0.76**	**542.13**	**2,005.6**
Other Waters of the U.S.									
Canals and Ditches	0.15	33.42	0.00	33.57	0.42	26.80	0.00	27.22	**60.79**
Permanent Ponds	0.00	83.30	0.00	83.30	0.00	0.20	0.00	0.20	**83.5**
Tidal Channel	0.00	0.00	3.24	3.24	0.00	0.00	3.14	3.14	**6.4**
Subtotal	**0.15**	**116.72**	**3.24**	**120.11**	**0.42**	**27.00**	**3.14**	**30.56**	**150.7**
Total	**38.29**	**1,541.83**	**3.39**	**1,583.61**	**11.89**	**556.90**	**3.90**	**572.69**	**2,156.3**

Notes:

[1] Levee expansion activities would occur on the interior of the islands and includes site grading and fill activities.

[2] Attendant facilities include construction of intakes, outfalls, and boat docks.

Source: Environmental Science Associates 2013

While the total amount of proposed effects to wetlands and other waters of the U.S. is substantially higher than that described in the 2001 FEIS (by approximately 630.2 acres), almost all of the additional affected acreage (99%) is attributed to the “farmed wetland” category, a wetland category that was not delineated in the 2001 wetland delineation. As described in Section 3.5, “Biological Resources,” the farmed wetland category is associated with flooded agricultural fields on the project islands, including fallow, corn, and rice fields, that exhibit standing water in late winter and early spring after water has been pumped off of the islands, but become dry enough to plant crops in late spring. For other wetland categories, potential effects are generally consistent with those described in the 2001 FEIS in terms of the quantity and quality of wetlands and other waters of the U.S. that would be affected.

USACE considers several factors when determining appropriate compensatory mitigation for project effects: (1) the functions and services of the wetlands and other waters of the U.S. that would be eliminated or degraded; (2) the functions and services of waters of the U.S. that would be preserved, enhanced, and created on proposed mitigation sites; (3) the temporal loss of habitat; and (4) the likelihood of success of proposed mitigation. In general, compensatory mitigation should be located within the same watershed as the site where effects would occur, should be located where it is most likely to successfully replace lost functions and services, and should be on a site that is dedicated to preserving the wetlands in perpetuity. Compensatory mitigation may be achieved through restoration, enhancement, establishment, and in certain circumstances, preservation. Restoration is generally favored because the likelihood of success is greater, the effects to potentially ecologically important uplands are reduced compared to establishment, and the potential gains in terms of aquatic resource functions are greater, compared to enhancement and preservation (33 CFR Section 332.3). The amount of required compensatory mitigation must be, to the extent practical, sufficient to replace lost aquatic resource functions. In cases where appropriate functional or condition assessment methods or other suitable metrics are available, these methods should be used where practicable to determine how much compensatory mitigation is required. If a functional or condition assessment or other suitable metric is not used, a minimum one-to-one acreage or linear foot compensation ratio may be used. A mitigation ratio greater than one-to-one may be necessary to account for the method of compensatory mitigation (e.g., preservation), the likelihood of success, differences between the functions lost at the effect site, and the functions expected to be produced by the compensatory mitigation project, temporal losses of aquatic resource functions, the difficulty of restoring or establishing the desired aquatic resource type and functions, and/or the distance between the affected aquatic resource and the compensation site (33 CFR Section 332.3).

As described in the Draft CMP (Appendix B), approximately 3,669.3 acres of wetlands and 250.9 acres of other waters of the U.S. on the Habitat Islands would be restored and protected in perpetuity, for a total of 3,920.2 total acres of restored wetlands and other waters of the U.S. In addition, approximately 844.8 acres of wetlands and 135.8 acres of other waters of the U.S. would be preserved in perpetuity on the Habitat Islands, for a total of 980.6 acres of preserved wetlands and other waters of the U.S. (See Table 3.4-1 above for a summary of the habitat types that would be restored and preserved.) The Final CMP would also meet the requirements of the 2008 Mitigation Rule.

In summary, based on the predicted acreage of restored and preserved wetlands presented in the Conceptual Restoration Plans (Exhibits 1 and 2 of Appendix B), the post-project acreage on the project islands would consist of approximately:

- 1,960 acres of farmed wetlands (net decrease of approximately 657 acres)
- 1,334 acres of freshwater marsh (net increase of approximately 741 acres)
- 533 acres of seasonal wetlands (net increase of approximately 533 acres)
- 492 acres of cottonwood-willow (net increase of approximately 279 acres)
- 268 acres of Great Valley willow scrub (net increase of approximately 137 acres)
- 125 acres of canals and ditches (net increase of approximately 0.4 acre)
- 262 acres of permanent ponds (net increase of approximately 102.4 acres)
- 10,798 acres of seasonal open water (Reservoir Islands)

The total existing acreage of wetlands and waters of the U.S. combined from all four project islands is 3,838.52. The post-project acreage of wetlands and waters of the U.S. would be 4,972.73 (excluding the 10,798 acres of seasonal open water habitat type that would be created with the construction of the Reservoir Islands). Therefore, implementation of Alternatives 1 or 2 would result in a net increase of approximately 1,134.21 acres of wetlands and waters of the U.S. As described in the Draft CMP (Appendix B) and the environmental commitments described above, restored and preserved wetlands would be actively managed in accordance with the Final CMP that is subject to final approval by USACE, USFWS, EPA, and DFW. Based on these considerations, Alternatives 1 and 2 would result in a net gain of wetlands or others waters of the U.S. acreage, and therefore this effect is **less than significant** and **beneficial**.

Mitigation Measure: No mitigation is required.

EFFECT AQR-12 **Loss of Tidal Marsh and Tidal Channel Habitats from Project Construction and Operation.** *Permanent loss of tidal marsh and Delta channel habitats would occur outside of the levees on the Reservoir Islands, but the project's environmental commitment to provide a conservation easement on Chipps Island would compensate for this loss. Therefore, this effect is less than significant.*

Tidal marsh habitat is located adjacent to the Reservoir Islands and Delta channels surrounding the project islands. Under Alternatives 1 and 2, permanent effects to (i.e., loss of) tidal marsh (0.9 acre) and tidal channel habitats (6.4 acres) (see Table 3.4-15) would occur outside of the levees on the Reservoir Islands as a result of constructing intake and outfall facilities and associated support structures. However, as described in the "Environmental Commitments" subsection above, the project applicant would provide a conservation easement on up to 40 acres of shallow-water vegetated habitat at Chipps Island. This would preserve up to 40 acres of tidal marsh habitat in perpetuity. A management plan for the conservation area would be developed by the project applicant within the first year of project operation for the habitat covered by the conservation easement, and would be incorporated as an exhibit to the easement. Additionally, adequate financing for long-term management of the conservation easement would be demonstrated by the project applicant prior to the start of any construction activity that could affect tidal marsh and tidal channels. With implementation of this environmental commitment, tidal marsh and tidal channel habitat would be permanently protected at a ratio of approximately 5.3 to 1. Therefore, the permanent effect to tidal marsh and tidal channel habitats is **less than significant**.

Mitigation Measure: No mitigation is required.

EFFECT AQR-13 **Habitat Conversion and Potential Effects on Associated Special-Status Species from Implementing Chipps Island Conservation Easement.** *The Chipps Island Conservation Easement would result in permanent protection of 200 acres of existing tidal channel and 40 acres of existing shallow water tidal marsh habitat. This effect is less than significant and beneficial.*

Alternatives 1 and 2 require implementation of an off-site conservation easement on 240 acres of Chipps Island to mitigate for adverse effects to special-status fish species and loss of tidal marsh and tidal channel habitat. Chipps Island is owned by the project applicant and available for conservation. Under the proposed conservation easement, approximately 200 acres of tidal channel and 40 acres of shallow water tidal marsh habitat would be placed under a conservation easement in perpetuity and the project applicant would establish adequate funding for long term management. The channels and marshes of Chipps Island provide suitable habitat for special-status fish species and may over time provide habitat for other special-status plant and wildlife species. Thus, implementation of the project including the conservation easement on Chipps Island results in an increase of 240 acres of permanently protected tidal Channel and tidal marsh habitat and associated habitat functions and values. This effect is **less than significant** and **beneficial**.

Alternative 3

EFFECT AQR-1 **Alteration of Fish Habitat through Construction of Project Facilities.** *Construction of intake facilities and fish screens, discharge facilities, and maintenance boat docks on the Reservoir Islands could adversely change spawning and rearing habitat used by Delta fish species, resulting in habitat loss. Therefore, this effect is significant.*

The effects related to alteration of fish habitat from project-related construction activities under Alternative 3 would be similar to the effects under Alternatives 1 and 2. However, Alternative 3 would also include the construction of intakes and outfall structures on Holland Tract and Bouldin Island. Historical and ongoing Federal, state, and local agency and private activities (e.g., dredging, placement of riprap, and levee construction) have destroyed substantial areas of shallow-water vegetated habitat in the Delta, and recent downward trends in the population abundance of delta smelt may indicate the need to preserve the remaining habitat. If project intake sites or maintenance boat docks were located in or near shallow-water vegetated habitat, spawning habitat for delta smelt could be lost or altered. The habitat area lost would be small relative to the total area of similar habitat in the Delta, and such loss would have minimal effects on Delta-wide fish populations. However, loss of habitat could have a substantial adverse effect on localized reproduction of delta smelt. Given the reduced abundance of delta smelt and other species, loss of habitat could still occur and this could constitute a substantial reduction in habitat or range. Therefore, this effect is considered **significant**.

Mitigation Measure: Implement Mitigation Measure AQR-MM-1 (Minimize Effects to Shallow-Water Vegetated Habitat and Replace Habitat Loss at a Ratio of 3:1).

Mitigation Measure: Implement Mitigation Measure AQR-MM-2 (Site Project Facilities to Avoid Existing Shallow-Water Vegetated Habitat).

Mitigation Measure: Implement Mitigation Measure AQR-MM-3 (Limit Waterside Construction to Less Sensitive Time Periods [August-October]).

Implementation of the environmental commitments discussed previously along with Mitigation Measures AQR-MM-1, AQR-MM-2, and AQR-MM-3 would reduce the significant effect from construction-related alteration of fish habitat to a **less-than-significant** level because effects would be avoided and/or minimized where possible and the replacement of any lost habitat at a ratio of 3:1 would fully mitigate for any habitat losses.

EFFECT AQR-2 **Operation-Related Increase in Organic Materials and Toxics and Decrease in Dissolved Oxygen of Delta Water from Project Discharges.** *Although the project's environmental commitments and FOC terms include project operating restrictions that preclude significant effects of the project on DO levels and avoid a substantial reduction in habitat for fish and other aquatic species, water discharged from project islands may contain materials that would be toxic to aquatic organisms. Therefore, this effect is significant.*

Water discharged from the four project islands under Alternative 3 may have elevated levels of DOC but reduced quantities of particulate organic carbon (because of settling). Based on the water quality analysis contained in Section 3.11, "Hydrology and Water Quality," discharge of such additional material is not expected to have substantial adverse biological effects in the Delta and could increase availability of food for Delta fishes (see effect WQ-10 in Section 3.12). Discharge of water for export (July–November) or for outflow (i.e., beneficial use in October–November) that has lower DO levels could have adverse effects on salmonids that are sensitive to low levels of DO. However, water would be discharged at times of the year when the effects on salmonids would be minimal because the primary migration period is from December to June. The greatest potential for adverse effects from releases due to elevated water temperature is for late-fall-run Chinook salmon. However, with implementation of the environmental commitments described previously, project discharges would be prohibited from reducing DO levels in the receiving channel by more than 1 mg/l. The FOC terms also include project operating restrictions that preclude significant effects of the project on DO levels and avoid a substantial reduction in habitat for fish and other aquatic species.

Pesticides, which are currently a component of agricultural discharges, would only be applied under Alternative 3 in the NBHA. However, Effect 3.10-1 in Section 3.10, “Hazardous Waste and Materials,” discusses the locations and types of potential contamination sites that have been identified on Bacon Island and Holland Tract. The identified sites on Bacon Island (one of the Reservoir Islands) consist of farm machinery repair facilities, pesticide storage areas, domestic waste dumps, and a copper salvaging site. On Holland Tract (one of the Habitat Islands), historical pulp disposal areas were identified. No potential contamination sites were identified on Webb Tract or Bouldin Island. Water storage on Bacon Island and Holland Tract could mobilize soil contaminants from historical pollution sites. If the contaminant concentrations are high, mobilization of the dissolved fraction of the contaminants could cause an adverse effect on Delta channel water quality and, in turn, adversely affect aquatic life and habitat from discharged water. This effect is **significant**.

Mitigation Measure: Implement Mitigation Measure HZ-MM-1 (Conduct Assessments of Potential Contamination Sites and Remediate as Necessary).

Implementation of Mitigation Measure HZ-MM-1 would reduce this effect to a **less-than-significant** level because potential contamination sites would be assessed and if contaminants are likely to mobilize into the stored water, the project applicant would develop and implement plans for site remediation. Such site assessments and remediation typically would be performed under the supervision of the Central Valley RWQCB. All required assessments and remediation would be completed prior to the beginning of project water storage.

EFFECT AQR-3 Temperature-Related Effects on Chinook Salmon and Other Species from Project Operations. *Project environmental commitments and FOC terms include project operating restrictions that preclude significant effects of the project on temperature levels and would thereby avoid a substantial reduction in habitat for fish and other aquatic species. Thus, this effect is less than significant.*

Water quality-related operational effects from Alternative 3 would be similar to those described above for Alternatives 1 and 2, except that warmer water with a high DO content could be discharged from all four project islands rather than just the Reservoir Islands. If the temperature on the project islands were to be substantially greater than water temperature in the adjacent Delta channels, project discharges could increase channel water temperature. Increased channel water temperature could affect survival, growth, reproduction, and movement of aquatic organisms, especially salmonids. However, as discussed in detail under Alternatives 1 and 2, water would be discharged at times of the year when the effects on salmonids would be minimal because the primary migration period is from December to June. Furthermore, as discussed previously in the “Environmental Commitments” subsection, the project includes a temperature assessment and regulation program that has been specifically designed to avoid a substantial reduction in habitat for fish and other aquatic species. Therefore, this effect is **less than significant**.

Mitigation Measure: No mitigation is required.

EFFECT AQR-4 Potential Effects to Aquatic Life Resulting from an Increase in Accidental Spills of Fuel and Other Materials and Boat Wake Erosion During Project Operations. *Construction and operation of the proposed water storage facilities would result in only minor increases in boat traffic. These increases would not result in substantial new effects to aquatic life from accidental fuel and oil spills or from boat wake erosion. Therefore, this effect is less than significant.*

As discussed in Section 3.17, “Traffic and Transportation” (Table 3.17-3), construction of the proposed water storage facilities under Alternative 3 would result in approximately 45 additional boat trips per day. Project operation under Alternative 3 would generate approximately 14 daily boat trips.

This small number of increased boat trips during the project's construction and operational phases would not result in substantial effects from accidental spills of fuel and lubricants and would not substantially increase boat wake erosion. Thus, project-related boating activities would have a **less-than-significant** effect on sensitive Delta species.

Mitigation Measure: No mitigation is required.

EFFECT AQR-5 **Effects on Juvenile Chinook Salmon from Diversions and Releases.** *Project operations would result in small increases in entrainment during certain periods, but these fish may represent an important loss to the population in terms of genetically fitter individuals. Therefore, this effect is significant.*

The potential effects to Chinook salmon consist of entrainment during diversions to the project islands and, to a lesser extent, during discharges of project water for export, along with possible exposure to reduced water quality (as addressed above in effects AQR-2 and AQR-3) during discharge of project water. There is also a potential for project diversions to provide false outmigration cues to Chinook salmon juveniles traversing the Delta via the central Delta. The proposed reduction and screening of existing project agricultural diversions would offset the project losses for fall-run and spring-run Chinook salmon, but not for winter-run or late fall-run Chinook salmon because the main migration periods of the former two species overlap the main diversion period to a lesser extent than those of the latter two species. Given that the installed screens would be constructed to delta smelt standards, which are above those required for salmonids (i.e., approach velocity is lower), it is probable that the screened intakes would entrain very few salmonids (National Marine Fisheries Service 2009).

The conservation easement on Chipps Island included primarily as a benefit for delta and longfin smelt (see the "Environmental Commitments" subsection above) would also benefit Chinook salmon; Chipps Island is an estuarine area that is included in critical habitat designations for winter-run and spring-run Chinook salmon. Because Chipps Island is located at a prominent location on the outmigration route, is likely to be of considerable importance to juvenile salmonids.

Compared to Alternatives 1 and 2, implementation of Alternative 3 would double the amount diversions to the project islands and would double the discharge of water for export and outflow; there would be no diversions for habitat. This would lead to substantially greater effects than under Alternative 2 (see Table 3.4-12). In general, doubling the diversions and exports would result in an approximate doubling of the effects. As discussed under Alternatives 1 and 2, the losses under Alternative 3 may be relatively small in numeric terms, but NMFS (2009) notes that the loss of individuals that have successfully survived many earlier threats prior to entry to the Delta may represent a substantial loss to the population in terms of genetically fitter individuals. This may represent a substantial reduction in abundance of Endangered winter-run Chinook salmon and Threatened spring-run Chinook salmon. Therefore, this effect is **significant**.

Mitigation Measure: Implement Mitigation Measure AQR-MM-1 (Minimize Effects to Shallow-Water Vegetated Habitat and Replace Habitat Loss at a Ratio of 3:1).

Mitigation Measure: Implement Mitigation Measure AQR-MM-4 (Implement a Fishery Improvement Mitigation Fund).

Implementation of Mitigation Measures AQR-MM-1 and AQR-MM-4 would reduce this effect, but not to a less-than-significant level because the loss of individuals may represent a substantial loss to the overall population in terms of genetically fitter individuals that have survived passage to the Delta and may substantially reduce the abundance of this species. There are no additional feasible mitigation measures available to fully reduce this adverse effect to a less-than-significant level. Therefore, this effect is **significant and unavoidable**.

EFFECT AQR-6 **Effects on Juvenile Steelhead from Diversions and Releases for Diversions**. *Project operations would result in small increases in entrainment during certain periods, but these fish may represent an important loss to the population in terms of genetically fitter individuals. Therefore, this effect is significant.*

Steelhead could be affected by changes in water quality due to project discharges; entrainment at project diversions and, to a lesser extent, entrainment during export of discharged project water; and increased Delta mortality because of altered hydrodynamics or false outmigration cues caused by project diversions. Compared to Alternatives 1 and 2, implementation of Alternative 3 would double diversions to the project islands and would double the discharge of water for export and outflow; there would be no diversions for habitat. This would lead to substantially greater effects than under Alternative 2 (see Table 3.4-12). In general, doubling the diversions and exports would result in an approximate doubling of the effects.

Changes in water quality would be minimized by the environmental commitments detailed previously such as the FOC and WQMP. Estuarine areas are important critical habitat for steelhead (National Marine Fisheries Service 2009:113); therefore, the species would also benefit from the project's environmental commitment to establish a perpetual shallow-water conservation easement at Chipps Island. However, the loss of individuals under Alternative 3 may represent a substantial loss to the population in terms of genetically fitter individuals that have survived passage to the Delta and may substantially reduce the abundance of this species. Therefore, this effect is **significant**.

Mitigation Measure: Implement Mitigation Measure AQR-MM-1 (Minimize Effects to Shallow-Water Vegetated Habitat and Replace Habitat Loss at a Ratio of 3:1).

Mitigation Measure: Implement Mitigation Measure AQR-MM-4 (Implement a Fishery Improvement Mitigation Fund).

Implementation of the various environmental commitments discussed previously along with Mitigation Measures AQR-MM-1 and AQR-MM-4 would reduce this effect, but not to a less-than-significant level because the loss of individuals may represent a substantial loss to the overall population in terms of genetically fitter individuals that have survived passage to the Delta and may substantially reduce the abundance of this species. There are no additional feasible mitigation measures available to fully reduce this adverse effect to a less-than-significant level. Therefore, this effect is **significant and unavoidable.**

EFFECT AQR-7 **Effects on Delta Smelt from Diversions and Releases.** *Project operations would result in small increases in entrainment during certain periods; however, given the long-term downward trend in abundance of delta smelt, this effect is significant.*

Delta smelt are estuary-resident fish, inhabiting the Delta and other portions of the San Francisco Bay estuary throughout their lives. Thus, several life stages (i.e., eggs, larvae, juveniles, and adults) may be adversely affected by the project. As discussed in detail under Alternatives 1 and 2, effects under Alternative 3 would primarily occur from loss of habitat during construction and entrainment. Compared to Alternatives 1 and 2, implementation of Alternative 3 would double the amount of diversions to the project islands and double discharge of water for export and outflow; there would be no diversions for habitat. This would lead to substantially greater effects than Alternative 2 (see Tables 3.4-11 and 3.4-12). In general, doubling the diversions and exports would result in an approximate doubling of the effects. Given the long-term downward trend in abundance of delta smelt, the additive effects of the project may substantially reduce the abundance of this listed species. Therefore, this effect is **significant**.

Mitigation Measure: Implement Mitigation Measure AQR-MM-1 (Minimize Effects to Shallow-Water Vegetated Habitat and Replace Habitat Loss at a Ratio of 3:1).

Mitigation Measure: Implement Mitigation Measure AQR-MM-4 (Implement a Fishery Improvement Mitigation Fund).

Implementation of the environmental commitment to place a conservation easement on approximately 240 acres at Chipps Island and implementation of Mitigation Measures AQR-MM-1 and AQR-MM-4 would reduce this effect, but not to a less-than-significant level because of the current low abundance of delta smelt and the uncertainty associated with the effectiveness of the mitigation proposed. There are no additional feasible mitigation measures available to fully reduce this adverse effect to a less-than-significant level. Therefore, this effect is **significant and unavoidable**.

EFFECT AQR-8 Effects on Longfin Smelt from Diversions and Releases. *Project operations would result in small increases in entrainment during certain periods; however, given the long-term downward trend in abundance of longfin smelt, this effect is significant.*

Longfin smelt, as with delta smelt, may be affected by the project at several stages of their life cycle, including reductions in spawning habitat and entrainment of juveniles and adults. The greatest potential effect on the longfin smelt population is estimated to be caused by diversions during January to June, which may result in an average decrease in subadult population abundance (indexed by the FMWT survey). Compared to Alternatives 1 and 2, implementation of Alternative 3 would double diversions to the project islands and double discharge of water for export and outflow; there would be no diversions for habitat. This would lead to substantially greater effects than Alternative 2 (see Tables 3.4-11 and 3.4-12). In general, doubling the diversions and exports would result in an approximate doubling of the effects. Given the long-term downward trend in abundance of longfin smelt, the additive effects of the project may substantially reduce the abundance of this listed species. Therefore, this effect is **significant**.

Mitigation Measure: Implement Mitigation Measure AQR-MM-1 (Minimize Effects to Shallow-Water Vegetated Habitat and Replace Habitat Loss at a Ratio of 3:1).

Mitigation Measure: Implement Mitigation Measure AQR-MM-4 (Implement a Fishery Improvement Mitigation Fund).

Implementation of the environmental commitments detailed above (e.g., water quality standards, spill prevention, reduction in boat wake erosion, and reductions in diversion/discharge during smelt presence) and implementing Mitigation Measures AQR-MM-1 and AQR-MM-4 would reduce this effect. Implementing placement of a conservation easement on approximately 240 acres at Chipps Island as an environmental commitment would reduce some of the loss of optimal salinity habitat. Although the environmental commitments and mitigation measures listed above would reduce the project's effect on longfin smelt, the effect would not be reduced to a less-than-significant level due to the uncertainty associated with implementation of these mitigation measures. There are no additional feasible mitigation measures available to fully reduce this adverse effect to a less-than-significant level. Therefore, this effect is **significant and unavoidable**.

EFFECT AQR-9 Effects on Green Sturgeon from Diversions and Releases. *Project operations would result in small increases in entrainment during certain periods, and given that these losses could be important to the overall abundance of green sturgeon, this effect is considered significant.*

NMFS (2009:131) notes that good water quality is important for green sturgeon. Discharges of project water could affect juvenile sturgeon and restrict their distribution, although the environmental commitments to maintain adequate water quality standards would minimize this effect. Juvenile green sturgeon may be entrained at the SWP/CVP pumping facilities during export of discharged project water. Compared to Alternatives 1 and 2, Alternative 3 would double diversions to the project islands and would double the discharge of water for export and outflow; there would be no diversions for habitat. This would lead to substantially greater effects than Alternative 2 (see Table 3.4-12). In general, doubling the diversions and exports would result in approximate doubling of the effects. Although the estimated average loss of green sturgeon is projected to be small, this could represent an important effect on the abundance of the population, therefore this effect is considered **significant**.

Mitigation Measure: Implement Mitigation Measure AQR-MM-4 (Implement a Fishery Improvement Mitigation Fund).

Implementation of the project's environmental commitments discussed previously and implementation of Mitigation Measure AQR-MM-4 would reduce the effect of the project on green sturgeon, but not to a less-than-significant level because the declining population abundance may make even a small loss substantial and reduce the population towards levels that are no longer self-sustaining. There are no additional feasible mitigation measures available to fully reduce this adverse effect to a less-than-significant level. Therefore, this effect is **significant and unavoidable.**

EFFECT AQR-10 — Effects on Other Aquatic Species from Diversions and Releases. *Project operations would result in small increases in entrainment during certain periods. However, no substantial reduction in abundance, range, or habitat for any other species is anticipated. Therefore, this effect is less than significant.*

The project may affect many common fish and invertebrate species inhabiting regions of the Delta and downstream that may be influenced by project operations. Losses would primarily occur through entrainment, and also loss of habitat. The prominence and broad distribution of nonnative species such as striped bass, white catfish, American shad, and threadfin shad in the Delta mean that they may have appreciable numeric losses attributable to the project. However, these losses would likely represent only a small portion of the total populations and would be unlikely to constitute a substantial reduction in abundance or range. For native species that may occasionally inhabit the Delta (e.g., starry flounder), localized effects may occur, but the bulk of the population is likely to be far enough downstream that effects of project operations would be minimal.

Compared to the Alternatives 1 and 2, implementation of Alternative 3 would double the diversions to the project islands and would double the discharge of water for export and outflow; there would be no diversions for habitat. This would lead to substantially greater effects than Alternative 2 (see Table 3.4-12). In general, doubling the diversions and exports would result in an approximate doubling of the effects. However, no substantial reduction in abundance, range, or habitat for any other species is anticipated and the environmental commitments described previously would also benefit common fishes and invertebrates and would further reduce this effect. Therefore, this effect is **less than significant**.

Mitigation Measure: No mitigation is required.

EFFECT AQR-11 — Effects to Wetlands and Other Waters of the U.S. from Construction and Operation. *Alternative 3 would result in a loss of approximately 3,699 acres of wetlands and other waters of the U.S. Therefore, this effect is significant.*

Invasive Species

With respect to invasive species, the project would not include elements or sources of water that would introduce invasive species. Delta water would be used to flood the Reservoir Islands and irrigate the Habitat Islands. As a result, project operations would not affect the type or amount of invasive species in the Delta.

Within the Delta, benthic macroinvertebrates typically live within the top 12 inches of sediment, while epibenthic macroinvertebrates typically live on the sediment surface. Within Suisun Bay, and the western and central Delta, benthic and epibenthic species include bay shrimp, opossum shrimp, amphipods, polychaetes, oligochaetes, and clams. The nonnative Asian clam (*Corbicula fluminea*) has rapidly expanded its geographic distribution and abundance within Suisun Bay and the central Delta (Thompson and Peterson 1998) and has achieved sufficiently high population abundance that feeding (clams are filter feeders) has substantially altered the abundance of phytoplankton and zooplankton within the estuary.

Characteristics of the benthic and epibenthic macroinvertebrate community are influenced by a variety of physical and water quality conditions that occur within the Delta, the most important being flow velocities, substrate characteristics, and salinity gradients (Thompson et al. 2000). As stated in Herbold et al. (1992), the factors most affecting the abundance, composition, and health of the benthic community from year to year are outflow from the Delta, local runoff, and pollution (Nichols and Pamatmat 1988). Lower outflows tend to be associated with lower phytoplankton biomass and hence lower productivity during periods of low flow. High outflows lead to lower salinities, which particularly control the species abundance and composition in shallow areas where animals are exposed to less saline surface water.

Benthic communities in the Bay-Delta estuary have also been influenced by disturbances such as dredging and filling activities. Sediment grain-size distributions show that sandy sediments persist in areas of high current velocities such as the channel areas (Rubin and McCulloch 1979), while finer sediments settle in areas of lower current velocity such as in the shoals and small channels (Krone 1979) and in the shallow open water habitat in flooded islands such as Franks Tract. Benthic and epibenthic invertebrate populations are generally most abundant in areas having reduced water velocities, fine-grained sediments, and relatively stable benthic environments (little sediment resuspension, movement or disturbance, slow rates of accretion or depletion of sediments). In deeper water channel, and high velocity areas characterized by sand and coarse substrate with substantial daily, seasonal or interannual substrate movement and accretions and depletions, benthic and epibenthic macroinvertebrate communities characteristically have reduced species diversity and abundance.

Many of the more common benthic species that inhabit the estuary are not native to the region but have been transported and introduced into the estuary through the discharge of ballast water from commercial ships, or on the shells of oysters brought from the East Coast for commercial farming in the late 19th century (Carlton 1979). Over 40% of the individuals comprising the benthic community in a given area of the estuary can be nonindigenous species (Carlton 1979; Cohen 2000). Many of these introduced species may serve ecological functions similar to native species that they may have displaced; however, some species may be detrimental to the aquatic ecosystem of the estuary. All but two of the benthic mollusks (i.e., oysters and clams) are introduced. Within the vicinity of Franks Tract, one of the dominant mollusks, the Asian clam, is intolerant of saline waters.

The project has the potential to result in effects to the benthic invertebrate community, including invasive clams, during construction, including the installation of diversion and discharge facilities. These effects would be temporary and relatively small. In addition, since the reservoirs are seasonal, it will be difficult for invasives to flourish above current population levels since their lifecycle would be interrupted because their aquatic habitat would be removed every year. Therefore, while some non-native benthic species may persist in areas of the reservoirs once drained, the population levels of these non-native benthic species are not expected increase over current levels.

Over the long-term, the project could continue to result in relatively small, localized effects from the discharge of water from the Reservoir Islands and associated scour. It is anticipated that these effects would be very small, potentially indiscernible as it relates to aquatic invasive species and associated effects to native fish due to the temporary and localized nature of the discharge operations and because the discharge facilities are located in deeper water channel, and high velocity areas characterized by sand and coarse substrate with substantial daily, seasonal or interannual substrate movement and accretions and depletions, where benthic and epibenthic macroinvertebrate communities characteristically have reduced species diversity and abundance. Therefore, this effect is **less than significant.**

Mitigation Measure: No mitigation is required.

Loss or Conversion of Wetlands and other Waters

Changes in the wetland acreage on Bacon Island and Webb Tract under Alternative 3 would be the same as those described under Alternatives 1 and 2. However, Alternative 3 would also include the use of Bouldin Island and Holland Tract for water storage. Thus, the total effects to jurisdictional wetlands on the Habitat Islands would be greatly increased when compared to Alternatives 1 and 2. Implementation of Alternative 3 would result in the loss or conversion of approximately 3,712 acres of wetlands and other waters of the U.S. as shown in Table 3.4-17. The NBHA, which would be avoided under Alternative 3, currently contains approximately 139 acres of jurisdictional waters (Environmental Science Associates 2012). Approximately 50 acres of perennial ponds, 330 acres of seasonal managed wetland habitat, 170 acres of corn and wheat, 200 acres of riparian woodland, and 125 acres of herbaceous upland would be established and managed for wildlife in the NBHA. While these actions would provide some compensation for effects to wetland resources resulting from implementation of Alternative 3, they would not achieve a no-net-loss of wetlands functions and services. Therefore, the loss of wetlands and other waters of the U.S. resulting from implementation of Alternative 3 is a **significant** effect.

Table 3.4-17
Effects to Wetlands and Waters of the U.S under Alternative 3

Wetland Type	Bacon Island	Webb Tract	Bouldin Island	Holland Tract	Total Acres Affected (All Islands)
Wetlands					
Farmed Wetlands	406.5	1,100.5	381.6	625.2	2,513.8
Freshwater Marsh	116.9	159.0	122.6	166.5	565.0
Forested Wetlands	18.0	203.9	10.5	111.4	343.8
Tidal Marsh	0.8	0.2	0	0	1.0
Wetlands Subtotal	**542.2**	**1,463.6**	**514.7**	**903.1**	**3,423.6**
Other Waters					
Canals and Ditches	27.2	33.6	44.1	18.3	123.2
Open Water/Pond	0.2	83.3	1.0	75.0	159.5
Tidal Channel	3.1	3.2	0	0	6.3
Other Waters Subtotal	30.5	120.1	45.1	93.3	289.0
Jurisdictional Waters Total	**572.7**	**1583.7**	**559.8**	**996.4**	**3,712.6**

Note: Totals subject to rounding.

Source: Environmental Science Associates 2012

Mitigation Measure AQR-MM-5: Compensate for Loss of Wetlands through an Off-Site Compensatory Mitigation Site.

To offset effects to wetlands and other Waters of the U.S. resulting from implementation of Alternative 3, the project applicant, in consultation with USACE, USFWS, EPA, and DFW, will develop and implement an off-site wetland mitigation plan for mitigating effects to Section 404 jurisdictional wetlands and other waters of the U.S. Wetland mitigation available at the NBHA may be considered as part of this plan. The off-site mitigation plan shall compensate for wetland losses at a ratio no less than 1:1. The required acreage may be higher, depending on the function and services of restored habitats that would be provided under the plan. Once suitable off-site mitigation areas have been identified, a CMP team will be established to develop the off-site mitigation plan. No project-related construction will be allowed until a compensation plan that guarantees adequate compensation acreage has been developed by the project applicant and approved by USACE, USFWS, EPA, and DFW.

Implementation of Mitigation Measure AQR-MM-5 would reduce the effect from loss of wetlands to a **less-than-significant** level because it would result in the replacement of wetland and other waters at ratios determined sufficient by the regulatory agencies to offset the loss of wetland functions and services.

EFFECT AQR-12 **Habitat Conversion and Potential Indirect Effects on Jurisdictional Wetlands from Implementing Off-Site Mitigation.** *Implementation of off-site compensatory mitigation could result in habitat conversion and indirect loss of jurisdictional wetland habitat. This effect is potentially significant.*

Alternative 3 requires off-site mitigation at a yet-to-be determined location in the Delta. Because the location for this mitigation is unknown at this time, it is not possible to determine and quantify the specific effects associated with implementing the mitigation. However, because activities associated with implementation of the off-site mitigation would be similar in nature to activities that would occur on the Habitat Islands under Alternatives 1 and 2, similar types of effects may occur. These consist of loss of wetlands and other sensitive natural communities such as riparian habitats due to habitat conversion.

Loss of habitat for special-status fish species, including the species discussed above. Under Alternatives 1 and 2, if different habitat types are affected by habitat conversion, additional species could be affected. (Effects to special-status terrestrial wildlife and plant species are discussed in Section 3.5, "Biological Resources.") Therefore, depending on the ultimate location chosen and the potential presence of these resources, effects related to biological resources from implementation of off-site mitigation are **potentially significant**.

Mitigation Measure: Implement Mitigation Measure BIO-MM-7 (Conduct Detailed Effects Assessment for Off-Site Mitigation Sites, Quantify Effects, and Include Necessary Mitigation in the Off-Site Compensatory Mitigation Plan).

Implementation of Mitigation Measure BIO-MM-7 would reduce effects on special-status aquatic species and jurisdictional wetlands and other sensitive natural communities (such as riparian communities) resulting from habitat conversion at the off-site mitigation site(s) to a **less-than-significant** level because the off-site compensatory mitigation plan (as required in Mitigation Measure AQR-MM-5) would be modified to include appropriate mitigation from any associated loss of habitat or special-status species.

EFFECT AQR-13 **Loss of Tidal Marsh and Tidal Channel Habitats from Project Construction and Operation.** *Permanent loss of tidal marsh and tidal channel habitats would occur outside of the levees on the project islands, but the project's environmental commitment to provide a conservation easement on Chipps Island would compensate for this loss. Therefore, this effect is less than significant.*

The effects under Alternative 3 pertaining to tidal marsh and tidal channels habitat types would be the same as those described under Alternatives 1 and 2 for the areas surrounding Bacon Island and Webb Tract. An additional loss of up to 1.82 acres of tidal marsh habitat and 12.76 acres of tidal channel habitat would occur in areas surrounding Holland Tract and Bouldin Island under Alternative 3 as a result of construction of additional intakes and outfalls and associated support structures. The total amount of habitat lost under Alternative 3 would consist of 2.72 acres of tidal marsh and 19.16 acres of tidal channel habitat. However, as described in the "Environmental Commitments" subsection above, the project applicant would provide a conservation easement on up to 40 acres of shallow-water vegetated habitat at Chipps Island. This would preserve up to 40 acres of tidal marsh habitat in perpetuity. A management plan for the conservation area would be developed by the project applicant within the first year of project operation for the habitat covered by the conservation easement, and would be incorporated as an exhibit to the easement. Additionally, adequate financing for long-term management of the conservation easement would be demonstrated by the project applicant prior to the start of any construction activity that could affect tidal marsh or tidal channels. This environmental commitment would compensate for project-related loss of tidal marsh and tidal channel habitats at a ratio of approximately 2.75 to 1. Therefore, this effect is **less than significant**.

Mitigation Measure: No mitigation is required.

EFFECT AQR-14	**Habitat Conversion and Potential Indirect Effects on Associated Special-Status Species from Implementing Chipps Island Conservation Easement.** *The Chipps Island Conservation Easement would result in permanent protection of 200 acres of existing tidal channel and 40 acres of existing shallow water tidal marsh habitat. This effect is less than significant and beneficial.*

The effects under Alternative 3 pertaining to the Chipps Island Conservation Easement would be the same as those described under Alternatives 1 and 2. Alternatives 1 and 2 require implementation of an off-site conservation easement on 240 acres of Chipps Island to mitigate for adverse effects to special-status fish species and loss of tidal marsh and tidal channel habitats. Chipps Island is owned by the project applicant and available for conservation. Under the proposed conservation easement, approximately 200 acres of tidal channel and 40 acres of shallow water tidal marsh habitat would be placed under a conservation easement in perpetuity and the project applicant would establish adequate funding for long term management. The channels and marshes of Chipps Island provide suitable habitat for special-status fish species and may over time provide habitat for other special-status plant and wildlife species. Thus, implementation of the project including the conservation easement on Chipps Island results in an increase of 240 acres of permanently protected tidal Channel and tidal marsh habitat and associated habitat functions and values. This effect is **less than significant** and **beneficial**.

Table 3.4-18
Comparison of Delta Wetlands Project 2001 FEIS and this SEIS Effects and Mitigation Measures for Aquatic Resources

2001 FEIS Effects and Mitigation Measures	SEIS Effects and Mitigation Measures
Alternatives 1 and 2 (Proposed Action)	
Impact F-1: Alteration of Habitat (LTS) **Mitigation:** No mitigation is required.	**Effect AQR-1:** Alteration of Fish Habitat through Construction of Project Facilities (LTS-M) **Mitigation Measure AQR-MM-1:** Minimize Effects to Shallow-Water Vegetated Habitat and Replace Habitat Loss at a Ratio of 3:1 **Mitigation Measure AQR-MM-2**: Site Project Facilities to Avoid Existing Shallow-Water Vegetated Habitat **Mitigation Measure AQR-MM-3**: Limit Waterside Construction to Less-Sensitive Time Periods **Effect AQR-2:** Operation-Related Increase in Organic Materials and Toxics and Decrease in Dissolved Oxygen of Delta Water from Project Discharges (LTS-M) **Mitigation Measure HZ-MM-1:** Conduct Assessments of Potential Contamination Sites and Remediate as Necessary
Impact F-2: Increase in Temperature-Related Mortality of Juvenile Chinook Salmon (LTS) **Mitigation:** No mitigation is required.	**Effect AQR-3:** Temperature-Related Effects on Chinook Salmon and Other Species from Project Operations (LTS) **Mitigation:** No mitigation is required.
Impact F-3: Potential Increase in Accidental Spills of Fuel and Other Materials (LTS) **Mitigation:** No mitigation is required.	**Effect AQR-4:** Potential Effects to Aquatic Life Resulting from an Increase in Accidental Spills of Fuel and Other Materials and Boat Wake Erosion During Project Operations (LTS) **Mitigation:** No mitigation is required.
Impact F-4: Potential Increase in the Mortality of Chinook Salmon Resulting from the Indirect Effects of DW Project Diversions and Discharges on Flows (LTS) **Mitigation:** No mitigation is required.	**Effect AQR-5:** Effects on Juvenile Chinook Salmon from Diversions and Releases (SU) **Mitigation Measure AQR-MM-1:** Minimize Effects to Shallow-Water Vegetated Habitat and Replace Habitat Loss at a Ratio of 3:1 **Mitigation Measure AQR-MM-4:** Implement a Fishery Improvement Mitigation Fund

Table 3.4-18
Comparison of Delta Wetlands Project 2001 FEIS and this SEIS Effects and Mitigation Measures for Aquatic Resources

2001 FEIS Effects and Mitigation Measures	SEIS Effects and Mitigation Measures
	Effect AQR-6: Effects on Juvenile Steelhead from Diversions and Releases (SU) **Mitigation Measure AQR-MM-1:** Minimize Effects to Shallow-Water Vegetated Habitat and Replace Habitat Loss at a Ratio of 3:1 **Mitigation Measure AQR-MM-4:** Implement a Fishery Improvement Mitigation Fund
Impact F-5: Reduction in Downstream Transport and Increase in Entrainment Loss of Striped Bass Eggs and Larvae, Delta Smelt Larvae, and Longfin Smelt Larvae (LTS) **Mitigation:** No mitigation is required.	Transport and entrainment losses now included in species-specific assessments.
Impact F-6: Change in Area of Optimal Salinity Habitat (LTS) **Mitigation:** No mitigation is required.	Salinity analysis now included in Effects AQR-7, AQR-8, and AQR-9.
Impact F-7: Increase in Entrainment Loss of Juvenile Striped Bass and Delta Smelt (LTS) **Mitigation:** No mitigation is required.	**Effect AQR-7:** Effects on Delta Smelt from Diversions and Releases (SU) **Mitigation Measure AQR-MM-1:** Minimize Effects to Shallow-Water Vegetated Habitat and Replace Habitat Loss at a Ratio of 3:1 **Mitigation Measure AQR-MM-4:** Implement a Fishery Improvement Mitigation Fund
Impact F-8: Increase in Entrainment Loss of Juvenile American Shad and Other Species (LTS) **Mitigation:** No mitigation is required.	**Effect AQR-10:** Effects on Other Aquatic Species from Diversions and Releases (LTS) **Mitigation:** No mitigation is required. **Effect AQR-8:** Effects on Longfin Smelt from Diversions and Releases (SU) **Mitigation Measure AQR-MM-1:** Minimize Effects to Shallow-Water Vegetated Habitat and Replace Habitat Loss at a Ratio of 3:1 **Mitigation Measure AQR-MM-4:** Implement a Fishery Improvement Mitigation Fund **Effect AQR-9:** Effects on Green Sturgeon from Diversions and Releases (SU) **Mitigation Measure AQR-MM-4:** Implement a Fishery Improvement Mitigation Fund
G-1: Increase in Freshwater Marsh and Exotic Marsh Habitats. (B) **Mitigation:** No mitigation is required.	**Effect AQR-11**: Effects on Wetlands and Other Waters of the U.S. from Construction and Operation (LTS) **Mitigation:** No mitigation is required.
G-2: Loss of Riparian and Permanent Pond Habitats. (LTS) **Mitigation:** No mitigation is required.	**Effect AQR-12**: Loss of Tidal Marsh and Tidal Channel Habitats from Project Construction and Operation (LTS) **Mitigation:** No mitigation is required.
Not previously evaluated.	**Effect AQR-13:** Habitat Conversion and Potential Effects on Associated Special-Status Species from Implementing Chipps Island Conservation Easement (LTS, B) **Mitigation:** No mitigation is required.

Table 3.4-18
Comparison of Delta Wetlands Project 2001 FEIS and this SEIS Effects and Mitigation Measures for Aquatic Resources

2001 FEIS Effects and Mitigation Measures	SEIS Effects and Mitigation Measures
Alternative 3	
Impact F-9: Alteration of Habitat (S) **Mitigation Measure F-1:** Implement Fish Habitat Management Actions	**Effect AQR-1:** Alteration of Habitat through Construction of Delta Wetlands Project Facilities (LTS-M) **Mitigation Measure AQR-MM-1:** Minimize Effects to Shallow-Water Vegetated Habitat and Replace Habitat Loss at a Ratio of 3:1 **Mitigation Measure AQR-MM-2**: Site Project Facilities to Avoid Existing Shallow-Water Vegetated Habitat **Mitigation Measure AQR-MM-3**: Limit Waterside Construction to Less-Sensitive Time Periods. **Effect AQR-2:** Increase in Organic Materials and Toxics and Decrease in Dissolved Oxygen of Delta Water because of Project Discharges (LTS-M) **Mitigation Measure HZ-MM-1:** Conduct Assessments of Potential Contamination Sites and Remediate as Necessary
Impact F-10: Increase in Temperature-Related Mortality of Juvenile Chinook Salmon (S) **Mitigation Measure F-2:** Monitor the Water Temperature of DW Discharges and Reduce DW Discharges to Avoid Producing Any Increase in Channel Temperature Greater Than 1°F.	**Effect AQR-3:** Temperature-Related Effects on Chinook Salmon and Other Species (LTS) **Mitigation:** No mitigation is required.
Impact F-11: Potential Increase in Accidental Spills of Fuel and Other Materials (LTS) **Mitigation:** No mitigation is required.	**Effect AQR-4:** Potential Increase in Accidental Spills of Fuel and Other Materials and Boat Wake Erosion (LTS) **Mitigation:** No mitigation is required.
Impact F-12: Potential Increase in the Mortality of Chinook Salmon Resulting from the Indirect Effects of DW Project Diversions and Discharges on Flows (S) **Mitigation Measure F-3:** Operate the DW Project under Operations Objectives That Would Minimize Changes in Cross-Delta Flow Conditions during Peak Out-Migration of Mokelumne and San Joaquin River Chinook Salmon	**Effect AQR-5:** Effects on Juvenile Chinook Salmon from Diversions and Releases (SU) **Mitigation Measure AQR-MM-1:** Minimize Effects to Shallow-Water Vegetated Habitat and Replace Habitat Loss at a Ratio of 3:1 **Mitigation Measure AQR-MM-4:** Implement a Fishery Improvement Mitigation Fund **Effect AQR-6:** Effects on Juvenile Steelhead from Diversions and Releases (SU) **Mitigation Measure AQR-MM-1:** Minimize Effects to Shallow-Water Vegetated Habitat and Replace Habitat Loss at a Ratio of 3:1 **Mitigation Measure AQR-MM-4:** Implement a Fishery Improvement Mitigation Fund
Impact F-13: Reduction in Downstream Transport and Increase in Entrainment Loss of Striped Bass Eggs and Larvae, Delta Smelt Larvae, and Longfin Smelt Larvae (S) **Mitigation Measure F-4:** Operate the DW Project under Operations Objectives That Would Minimize Adverse Transport Effects on Striped Bass, Delta Smelt, and Longfin Smelt	Transport and entrainment losses now included in species-specific assessments.
Impact F-14: Change in Area of Optimal Salinity Habitat (LTS) **Mitigation:** No mitigation is required.	Salinity analysis now included in Effects AQR-7, AQR-8, and AQR-9.

Table 3.4-18
Comparison of Delta Wetlands Project 2001 FEIS and this SEIS Effects and Mitigation Measures for Aquatic Resources

2001 FEIS Effects and Mitigation Measures	SEIS Effects and Mitigation Measures
Impact F-15: Increase in Entrainment Loss of Juvenile Striped Bass and Delta Smelt (S) **Mitigation Measure F-5:** Operate the DW Project under Operations Objectives That Would Minimize Entrainment of Juvenile Striped Bass and Delta Smelt	**Effect AQR-7:** Effects on Delta Smelt from Diversions and Releases (SU) **Mitigation Measure AQR-MM-1:** Minimize Effects to Shallow-Water Vegetated Habitat and Replace Habitat Loss at a Ratio of 3:1 **Mitigation Measure AQR-MM-4:** Implement a Fishery Improvement Mitigation Fund
Impact F-16: Increase in Entrainment Loss of Juvenile American Shad and Other Species (LTS) **Mitigation:** No mitigation is required.	**Effect AQR-10:** Effects on Other Aquatic Species from Diversions and Releases **Mitigation:** No mitigation is required. **Effect AQR-8:** Effects on Longfin Smelt from Diversions and Releases (SU) **Mitigation Measure AQR-MM-1:** Minimize Effects to Shallow-Water Vegetated Habitat and Replace Habitat Loss at a Ratio of 3:1 **Mitigation Measure AQR-MM-4:** Implement a Fishery Improvement Mitigation Fund
	Effect AQR-9: Effects on Green Sturgeon from Diversions and Releases (SU) **Mitigation Measure AQR-MM-4:** Implement a Fishery Improvement Mitigation Fund **Effect AQR-11**: Effects on Wetlands and Other Waters of the U.S. from Construction and Operation (LTS-M) **Mitigation Measure AQR-MM-5**: Compensate for Loss of Wetlands through an Off-Site Compensatory Mitigation Site
Not previously evaluated.	**Effect AQR-12:** Habitat Conversion and Potential Indirect Effects on Jurisdictional Wetlands from Implementing Off-Site Mitigation (LTS-M) **Mitigation Measure BIO-MM-7:** Conduct Detailed Effects Assessment for Off-Site Mitigation Sites, Quantify Effects, and Include Necessary Mitigation in the Off-Site Compensatory Mitigation Plan
Impact G-5: Loss of Jurisdictional Wetlands on the Reservoir Islands (S) **Mitigation Measure G-4**: Develop and Implement an Off-Site Mitigation Plan	**Effect AQR-13**: Loss of Tidal Marsh and Tidal Channel Habitats from Project Construction and Operation (LTS) **Mitigation:** No mitigation is required.
Not previously evaluated.	**Effect AQR-14:** Habitat Conversion and Potential Effects on Associated Special-Status Species from Implementing Chipps Island Conservation Easement (LTS, B) **Mitigation:** No mitigation is required.

Notes: SU = Significant and unavoidable; LTS = Less than significant; LTS-M = Less than significant with mitigation; B = Beneficial

Sources: ICF 2010:4.5-5 through 4.5-9 and 4.6-3 through 4.6-4 and AECOM 2014

3.4.6 SECONDARY AND CUMULATIVE EFFECTS

AQUATIC RESOURCES

Secondary and cumulative project effects on fish are tied to past, present, and future environmental conditions, such as water resources management in the Delta, including past impacts to fish, aquatic, and wetlands, as well as current Delta hydrodynamics, SWP/CVP exports, and regulatory requirements such as the USFWS and NMFS OCAP BOs, and future reasonably foreseeable planned projects as discussed in Subsection 3.0.6, "Cumulative Context."

Secondary and cumulative effects on aquatic resources, including wetlands, resulting from project implementation were described in the 2001 FEIS (Chapters 3F and 3G) and the 2010 DEIR (Chapter 5). The 2001 FEIS and 2010 DEIR are herein incorporated by reference, and the effects conclusions and mitigation measures, along with any changes, are summarized briefly below and shown in Table 3.4-22.

Overview of Cumulative Conditions

A number of activities in the Delta that may cumulatively affect fish resources are summarized below relating to water diversions, contaminants, urbanization, climate change, nonnative species, and beneficial actions.

Water Diversions

Herren and Kawasaki (2001) enumerated 2,209 water diversions within the Delta, of which 17 were screened. As of May 2009, the total number of diversions listed in the California Fish Passage Assessment Database is 2,265, of which 20 are screened (CalFish 2009). For 1,881 of these, the maximum diversion capacity is not known. Not all diversions are functional. The 384 diversions for which capacity is known total almost 27,000 cfs, and about 16,000 cfs of this total are screened (with the SWP/CVP export facilities making up 15,200 cfs). This included 365 unscreened intakes and 19 screened intakes. Of the unscreened intakes, 82% were less than 50 cfs maximum capacity, and of the screened intakes 74% were less than 50 cfs maximum capacity. Aside from large diversions such as the SWP/CVP export facilities (see above), little study has been conducted of the numerous diversions in the Delta. Moyle and Israel (2005) conducted an extensive literature review and found only six studies related to the Delta and Suisun Marsh from which any quantitative information could be obtained. From the available information, it was not possible to ascertain whether the smaller diversions would have measurable effects at the population level, beyond the loss of individuals. Installation of fish screens in many cases may be indicative of a "precautionary approach that a diversion should be assumed to harm fish populations unless it can be proven otherwise" (Moyle and Israel 2005:26).

Contaminants

Fish inhabiting the Delta potentially are affected by a variety of contaminants. California's 2006 list of water quality-impaired water bodies, submitted to EPA as required under Section 303(d) of the CWA, names 13 pollutants for which total maximum daily loads (TMDLs) have been required (Table 3.4-19). Recent investigations related to the POD have shown that moderate to high levels of ammonia (in Sacramento River water samples) may result in high mortality of larval delta smelt during bioassays (Baxter et al. 2008). However, studies using biomarkers (e.g., histological abnormalities) to indicate the effects of contaminants have provided little evidence for adverse effects on delta smelt, longfin smelt, and threadfin shad but more evidence for striped bass, yellowfin goby, and inland silverside (Baxter et al. 2008:15–16).

Table 3.4-19 Contaminants in the Delta Identified as Requiring TMDLs	
Chlorpyrifos	Group A pesticides
DDT (dichlorodiphenyltrichloroethane)	Mercury
Diazinon	Organic enrichment/low dissolved oxygen
Dioxin	Pathogens
Electrical conductivity	PCBs (polychlorinated biphenyls)
Exotic species	Unknown toxicity
Furan compounds	

Note: TMDL = total maximum daily load

Source: California Environmental Protection Agency and State Water Resources Control Board 2007

Urbanization

The human population living in the counties bordering the Delta is projected to double in number from 2000 to 2050, with some counties possibly tripling in size (California Department of Finance 2007) (see Table 3.4-20). Accompanying these increases would be increased demand for water, among other resources. Increased urbanization tends to be accompanied by a number of cumulative effects on aquatic resources, including increased impervious surface levels (leading to greater runoff and stream flashiness) and contaminants. Bilby and Mollot (2008) demonstrated a substantial decline (75%) in incidences of Coho salmon spawning associated with increasing urbanization (50% more urban or industrial use) from 1986 to 2001 in several tributary streams of Puget Sound, Washington. Similar effects could occur in California for Chinook salmon or steelhead. Larger human populations may place a greater pressure on waters for recreation, with associated effects such as disturbance of streambeds and erosion of banks by recreational vessel wakes.

Table 3.4-20
Population Growth Projections in the Six Counties Bordering the Sacramento–San Joaquin River Delta

							2000–2050	
County	2000	2010	2020	2030	2040	2050	% Increase	Factor Increase
Alameda	1,453,078	1,550,133	1,663,481	1,791,721	1,923,505	2,047,658	41	1.4
Contra Costa	956,497	1,075,931	1,237,544	1,422,840	1,609,257	1,812,242	89	1.9
Sacramento	1,233,575	1,451,866	1,622,306	1,803,872	1,989,221	2,176,508	76	1.8
San Joaquin	569,083	741,417	965,094	1,205,198	1,477,473	1,783,973	213	3.1
Solano	396,995	441,061	503,248	590,166	697,206	815,524	105	2.1
Yolo	170,190	206,100	245,052	275,360	301,934	327,982	93	1.9
Total	**4,779,418**	**5,466,508**	**6,236,725**	**7,089,157**	**7,998,596**	**8,963,887**	**88**	**1.9**

Source: California Department of Finance 2007

Climate Change

Climate change is predicted to bring profound changes to California's natural environment. Hayhoe et al. (2004) describe the results of four climate change models: compared to 1960–1991, statewide average annual temperatures by 2070-2099 would be 2.3–5.8º Celsius (C) higher, average annual precipitation would be reduced by more than 100 mm, sea level would have risen 19.2–40.9 centimeters (cm), snowpack would have declined by 29–89%, and change in annual inflow to reservoirs would decline by more than 20%. (One model predicted slight increases in precipitation, snowpack, and reservoir inflow.) Changes in vegetation also are predicted, e.g., substantial decreases in the extent of alpine/subalpine forest, evergreen conifer forest, mixed evergreen woodland, and shrubland and increases in mixed evergeen forest and grassland (Hayhoe et al. 2004). Climate change is likely to cumulatively affect native fishes by increasing water temperatures (hence reducing DO), reducing streamflows, and increasing the likelihood of drought-related fires. A rise in sea level would lead to increasing rates of erosion, sedimentation, flooding, and inundation of low-lying coastal ecosystems. With reductions in snowmelt runoff, peak flows may come earlier as rainfall contributes more, which could affect species such as Central Valley spring-run Chinook salmon that have evolved their life history based on predictable runoff patterns (Williams 2006). Increasing temperatures may increase metabolic needs of fish predators and increase predation (Lindley et al. 2007). Moyle et al. (2008) qualitatively assessed the potential for climate-related effects on California's native salmonids (Table 3.4-21). Their analysis indicated that the majority of species (18 of 29, or 62%) were vulnerable in all or most of the watersheds inhabited; no species was invulnerable to climate change. Of the species that migrate through the Delta and may be cumulatively affected by the project, late fall–run, winter-run, and spring-run Chinook salmon were assessed to be "vulnerable in all watersheds inhabited," steelhead were "vulnerable in most watersheds inhabited," and fall-run Chinook salmon were "vulnerable in portions of watersheds inhabited" (Table 3.4-21).

Table 3.4-21
Qualitative Assessment of California Salmonids' Vulnerability to Climate Change

Vulnerability	Taxon
Vulnerable in all watersheds inhabited	Klamath Mountains Province Summer Steelhead[SSC]; Northern California Coastal Summer Steelhead[T,SSC]; Central California Coast Steelhead[T]; South–Central California Coast Steelhead[T,SSC]; Southern Steelhead[E,SSC]; Upper Klamath–Trinity Rivers Spring-Run Chinook Salmon[SSC]; **Central Valley Late Fall–Run Chinook Salmon[SC,SSC]; Sacramento Winter-Run Chinook Salmon[E,E]; Central Valley Spring-Run Chinook Salmon[T,T]**; Southern Oregon–Northern California Coastal Coho Salmon[T,T]; Central California Coast Coho Salmon[E,E]; McCloud River Redband Trout[SSC]; Eagle Lake Rainbow Trout[SSC]; Lahontan Cutthroat Trout[T]
Vulnerable in most watersheds inhabited (possible refuges present)	**Central Valley Steelhead[T];** Upper Klamath–Trinity Rivers Fall-Run Chinook Salmon; California Coast Chinook Salmon[T]; Goose Lake Redband Trout[SC]; Coastal Cutthroat Trout[SSC]
Vulnerable in portions of watershed inhabited (e.g., headwaters, lowermost reaches of coastal streams)	Northern California Coastal Winter Steelhead[T]; **Central Valley Fall-Run Chinook Salmon[SC];** California Golden Trout[SC,SSC]; Little Kern Golden Trout[T]; Kern River Rainbow Trout[SC,SSC]; Paiute Cutthroat Trout[T]; Mountain Whitefish
Low vulnerability because of location, cold water sources, and/or active management	Klamath Mountains Province Winter Steelhead; Resident Coastal Rainbow Trout; Southern Oregon–Northern California Coastal Chinook Salmon
Not vulnerable to significant population loss because of climate change	None

Notes: Species in **bold** migrate through the Delta and could be affected by Delta Wetlands project operations.

[SSC]Species of Special Concern (State), **[T]**Threatened (Federal), [T]Threatened (state), [E]Endangered (Federal), [E]Endangered (state), **[SC]**Species of Concern (Federal).

Source: Based on an analysis conducted by Moyle et al. 2008

Nonnative Species

Nonnative species have been introduced intentionally and incidentally into the Delta and neighboring areas for more than 100 years. Striped bass stocking and rearing activities are of particular importance. Striped bass originally were stocked into the project area in 1879, with artificial propagation attempted from 1907 to 1910 (Dill and Cordone 1997). DFW, in association with private aquaculturists, released 11 million fingerlings and yearlings from 1981 to 1991 in an attempt to offset declining abundance (see Exhibit 3.4-12). Following termination of the hatchery-rearing program because of concerns regarding predation by striped bass on listed species, striped bass juveniles were salvaged from the SWP diversion in the south Delta, reared for 1 or 2 years in net pens, and then released into the San Francisco Bay estuary (Moyle 2002). From 1993 to 2001, an average of more than 230,000 striped bass salvaged and reared by this program was released annually into the San Francisco Bay/Delta system (see Exhibit 3.4-12). It was hoped that the decline in striped bass adult abundance from 2.2 million adults in the 1960s–1970s to less than 1 million adults in the 1990s could be offset by this program, with the goal of stabilizing the population at about 3 million adults (Lindley and Mohr 2003). Lindley and Mohr (2003) estimated that the predatory effects of a population of 3 million adult striped bass would increase the probability of quasi-extinction (i.e., three consecutive spawning runs of fewer than 200 adults) of winter-run Chinook salmon to 55%, compared to probabilities of 28% with 512,000 striped bass adults or 30% with 700,000 striped bass adults.

Discharge of ballast water from foreign ships entering San Francisco Bay and the Delta probably has introduced several species. The introduced clam *Corbula amurensis* appears to have greatly depleted stocks of plankton upon which fish and other species depend (Kimmerer 2002). Yellowfin goby (*Acanthogobius flavimanus*) and shimofuri goby (*Tridentiger bifasciatus*) are well established in several coastal regions and may compete with native fauna, prey upon them, or be preyed upon by them (Moyle 2002; Workman and Merz 2007). A number of fish species have been introduced to enhance recreational fishing, either as targets for harvest (e.g., striped bass, brown trout, largemouth bass [*Micropterus salmoides*]) or else as bait (e.g., inland silverside, *Menidia beryllina*) (Moyle 2002). Inland silversides may prey upon eggs and larvae of delta smelt and compete with juveniles (Bennett 2005). Illegal introductions of fish and other animals, e.g., from the aquarium trade or for recreational fishing, is another pathway that may cumulatively affect native species.

Beneficial Actions

Measures outlined in the USFWS RPA (2008) and NMFS (2009) OCAP BOs are expected to improve conditions for fish resources in the Delta (see Section 3.4.2, "Affected Environment"). Many actions outside the Delta would benefit species such as salmonids that inhabit the Delta for portions of their life cycles. Examples of these actions include changes in operation of the Feather River Hatchery and Oroville Dam in relation to Federal Energy Regulatory Commission (FERC) relicensing, restoration of the San Joaquin River above its confluence with the Merced River for eventual reintroduction of Chinook salmon, and habitat restoration and removal of barriers to fish passage in Battle Creek and the Yuba River.

BDCP could provide the most benefit to fisheries resources in the Delta because of its numerous actions intended to balance the needs of aquatic organisms and humans. However, BDCP is only at the Draft EIR/EIS stage, and has substantial technical, legal, political, and financing hurdles to overcome prior to full implementation. At present, the primary components of the BDCP Conservation Strategy consist of: (1) the construction of new north Delta diversion facilities and an isolated conveyance facility in conjunction with operation of existing facilities; (2) detailed criteria that would govern the operations of the conveyance system across a range of hydrological conditions; (3) restoration of tidal marsh, floodplain, and riparian, and upland transition habitat; and (4) actions to address and control contaminants, nonnative invasive species, and predation; and to address other potentially important non-conveyance and non-habitat-related stressors on covered species (collectively called "other stressors").

Effects Analysis

Cumulative Effects on Listed Fish Species

The project's effects, in conjunction with ongoing cumulative conditions related to water diversions, contaminants, urbanization, climate change, and nonnative species, are likely to substantially reduce the abundance of sensitive Delta fish species, namely salmonids, delta and longfin smelt, and green sturgeon. While the project's incremental contribution is very small, existing environmental conditions are substantially degraded and the additional increment could contribute further to the decline of these species. There are beneficial elements of the project that could offset some of these effects, such as screening intakes and providing periodic water supply releases for environmental benefits. Furthermore, recent BO conditions that are currently in place require measures to improve Delta habitat conditions for sensitive Delta fish species over time, and BDCP efforts (assuming that BDCP is approved in the future) also are focused on measures to benefit these species. However, because the project could still contribute to the decline of listed fish species in the Delta, the project's contribution is cumulatively considerable.

> Mitigation Measure: Implement Mitigation Measure AQR-MM-1 (Minimize Effects to Shallow-Water Vegetated Habitat and Replace Habitat Loss at a Ratio of 3:1).

> Mitigation Measure: Implement Mitigation Measure AQR-MM-4 (Implement a Fishery Improvement Mitigation Fund).

Implementation of Mitigation Measures AQR-MM-1 and AQR-MM-4, along with the environmental commitments described above, would help reduce the project's contribution to this effect, but not necessarily to a level that is less-than-cumulatively considerable because of the substantial past and present adverse effects on listed fish species, the relatively unknown effects of climate change, and the highly speculative nature of future conditions and projects in the Delta. Additionally, there are no additional feasible mitigation measures available to fully reduce this adverse effect to a less-than-significant level. Therefore, this cumulative effect is considered significant and unavoidable.

Wetland Resources

The Delta has experienced pronounced changes over the past 150 years, primarily associated with resource extraction (i.e., placer mining), agricultural development, water supply development, and flood protection (Whipple et al. 2012). These changes resulted in a highly managed aquatic and terrestrial system, with salinity levels, water quality, levee integrity, fish and wildlife populations, and many other variables targeted under specific management objectives. Wetland resources have been dramatically reduced in the Delta from historic conditions. In addition, the introduction of invasive plant species, both in terrestrial and aquatic habitats, has substantially altered the Delta ecosystem and its wetlands.

Ongoing and planned future activities include the continuation of agricultural activities as well as infrastructure improvements. These projects often include levee construction and repair, channel dredging, channel bank rip-rap installation, island drainages, reclamation for agriculture, and infrastructure construction on the islands (e.g., roads, bridges, pump stations, drainage ditches, residences and equipment buildings). Many of these associated activities cause a reduction in acreage or function of wetlands. These circumstances have led to development of several plans, policies, and regulations that are intended to conserve and enhance the quality and distribution of remaining sensitive habitats, including wetlands, in the Delta. Alternatives 1 and 2 would arrest or reverse some of these trends through water storage and habitat creation. Alternative 3 may also arrest the adverse cumulative effects of continued subsidence, but would substantially reduce wetland habitat on the project islands.

The Fish Restoration Program Agreement (FRPA) was signed on October 10, 2010, and addresses specific habitat restoration requirements of USFWS and NMFS BOs for SWP/CVP operations. The primary objective of the

FRPA is to implement the BOs and Incidental Take Permit fish habitat restoration requirements and related actions in the Delta, Suisun Marsh, and Yolo Bypass with a focus on creating 8,000 acres of intertidal marsh habitat for delta smelt habitat and juvenile Chinook salmon. The Suisun Marsh Restoration Program is another joint agency plan to improve several facets of Suisun Marsh, including wetlands restoration and enhancement. Other restoration projects are proposed for the North Delta.

BDCP is proposing large-scale changes in the Delta region, including the creation/enhancement of approximately 100,000 acres of wetland and upland habitats as mitigation for Federal and state water projects aimed at improving the reliability of California's water supply. The wetland habitat creation proposed in Alternatives 1 and 2 would have a beneficial cumulative effect when combined with the actions currently proposed under BDCP, if those actions are eventually implemented. Alternative 3 would only potentially contribute to water quality goals proposed under BDCP. However, as discussed above, BDCP is still in the Draft EIR/EIS stage, and its full implementation is speculative at present.

EFFECTS ANALYSIS

Cumulative Effects on Wetlands and Other Waters of the U.S. in the Delta

Implementation of Alternatives 1 or 2 in conjunction with implementation of other Delta projects, with or without full implementation of BDCP, would result in a net increase in the acreage of freshwater marsh, cottonwood-willow, Great Valley willow scrub, and permanent pond habitats in the Delta. In addition to the project, other Delta projects that are currently in the planning phase or that would be planned and implemented over the lifetime of the Delta Wetlands project would be required to either protect existing wetland and riparian habitats or create new habitats as mitigation to offset wetland and riparian habitat losses associated with past or future projects. Several large-scale restoration projects are currently proposed in the Delta, such as projects to be implemented under the FRPA and the Suisun Marsh Restoration Program, and it is likely that some of these projects will be implemented. Therefore, this cumulative effect is considered beneficial with regards to the project's contribution to a net increase in wetland habitat in the Delta when compared with current conditions.

Implementation of Alternative 3 would result in the loss or conversion of 3,712 acres of wetlands and other waters of the U.S. that are currently present on the four project islands (see Table 3.4-17). Because of the large amount of wetlands that would be adversely affected, the project's contribution to this effect is cumulatively considerable.

> Mitigation Measure: Implement Mitigation Measure AQR-MM-5 (Compensate for Loss of Wetlands through an Off-Site Compensatory Mitigation Site)
>
> Mitigation Measure: Implement Mitigation Measure BIO-MM-7 (Conduct Detailed Effects Assessment for Off-Site Mitigation Sites, Quantify Effects, and Include Necessary Mitigation in the Off-Site Compensatory Mitigation Plan)

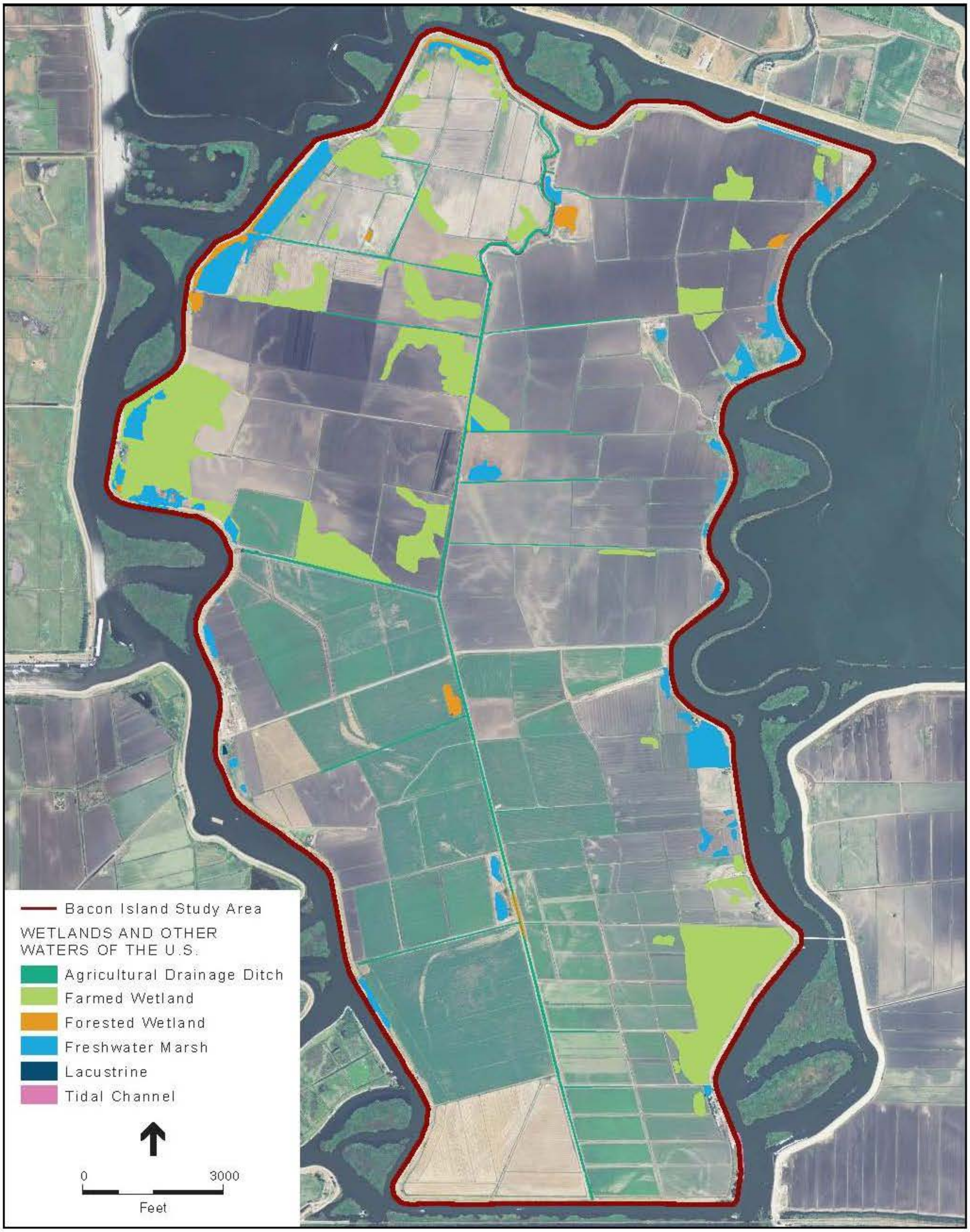
Implementation of Mitigation Measures AQR-MM-5 and AQR-MM-7, which require the development and implementation of a wetland mitigation plan for an off-site mitigation area and an effects assessment and compensation for any indirect effects of implementing off-site mitigation, would reduce the project's contribution to a level that is less-than-cumulatively considerable because the off-site mitigation plan would compensate for wetland losses at a ratio no less than 1:1.

Table 3.4-22
Comparison of Secondary and Cumulative Aquatic Resources Effects between the 2001 FEIS and this SEIS

2001 FEIS Effects and Mitigation Measures	SEIS Effects and Mitigation Measures
Impact F-17: Alteration of Habitat under Cumulative Conditions. (NCC) **Mitigation:** No mitigation is required.	Cumulative Effects on Listed Fish Species (CCU) **Mitigation Measures AQR-MM-1:** Minimize Effects to Shallow-Water Vegetated Habitat and Replace Habitat Loss at a Ratio of 3:1 **Mitigation Measure AQR-MM-4:** Implement a Fishery Improvement Mitigation Fund
Impact F-18: Potential Increase in Accidental Spills of Fuel and Other Materials under Cumulative Conditions. (NCC) **Mitigation:** No mitigation is required.	Cumulative effects of fuel and other spills are considered under “Cumulative Effects on Listed Fish Species”
Impact F-19: Potential Increase in the Mortality of Chinook Salmon Resulting from the Indirect Effects of Diversions and Discharges on Flows under Cumulative Conditions. (NCC) **Mitigation:** No mitigation is required.	Cumulative indirect effects on Chinook salmon resulting from effects of diversions and discharges on flows are considered under “Cumulative Effects on Listed Fish Species”
Impact F-20: Reduction in Downstream Transport and Increase in Entrainment Loss of Striped Bass Eggs and Larvae, Delta Smelt Larvae, and Longfin Smelt Larvae under Cumulative Conditions. (NCC) **Mitigation:** No mitigation is required.	Cumulative effects of entrainment are considered under “Cumulative Effects on Listed Fish Species”
Impact F-21: Change in Area of Optimal Salinity Habitat under Cumulative Conditions. (NCC) **Mitigation:** No mitigation is required.	Cumulative effects of changes in salinity habitat are considered under “Cumulative Effects on Listed Fish Species”
Impact F-22: Increase in Entrainment Loss of Juvenile Striped Bass and Delta Smelt under Cumulative Conditions. (NCC) **Mitigation:** No mitigation is required.	Cumulative effects of entrainment are considered under “Cumulative Effects on Listed Fish Species”
Impact F-23: Increase in Entrainment Loss of Juvenile American Shad and Other Species under Cumulative Conditions. (NCC) **Mitigation:** No mitigation is required.	Cumulative effects of entrainment are considered under “Cumulative Effects on Listed Fish Species”
G-7: Increase in Wetland and Riparian Habitats in the Delta (B)	Cumulative Effects on Wetlands and Other Waters of the U.S. in the Delta (Alternatives 1 and 2; Alternative 3- NCC-M) **Mitigation Measure AQR-MM-5**: Compensate for Loss of Wetlands through an Off-Site Compensatory Mitigation Site **Mitigation Measure BIO-MM-7**: Conduct Detailed Effects Assessment for Off-Site Mitigation Sites, Quantify Effects, and Include Necessary Mitigation in the Off-Site Compensatory Mitigation Plan
G-8: Cumulative Loss of Section 404 Jurisdictional Emergent Wetland and Riparian Habitats (NCC)	Cumulative loss of jurisdictional habitats are considered under “Cumulative Effects on Wetlands and Other Waters of the U.S. in the Delta”

Notes: CCU = Cumulatively considerable and unavoidable; NCC = Not cumulatively considerable; NCC-M = Not cumulatively considerable with mitigation; B = Beneficial

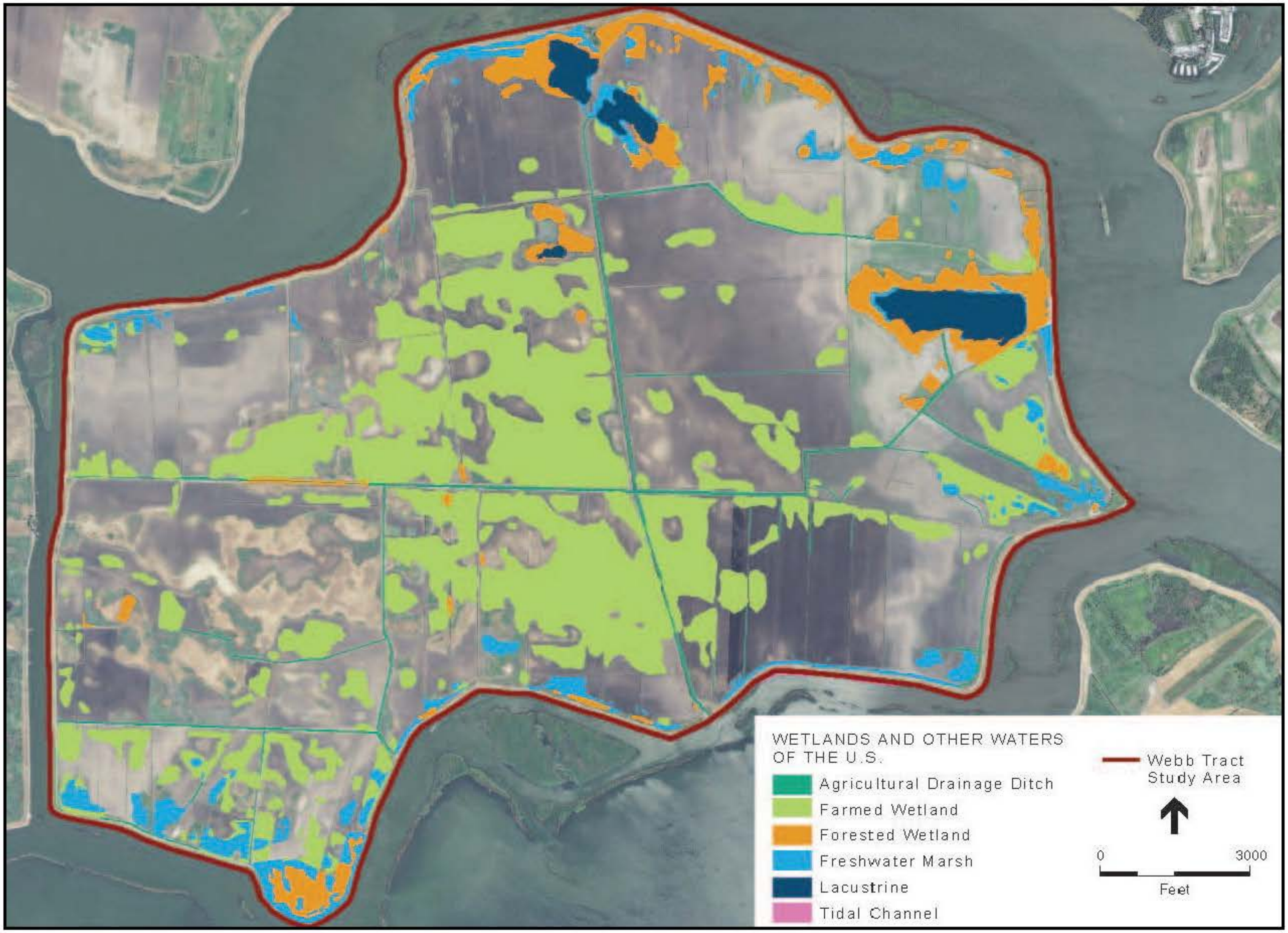
Sources: ICF 2010:5-44 through 5-51 and AECOM 2014



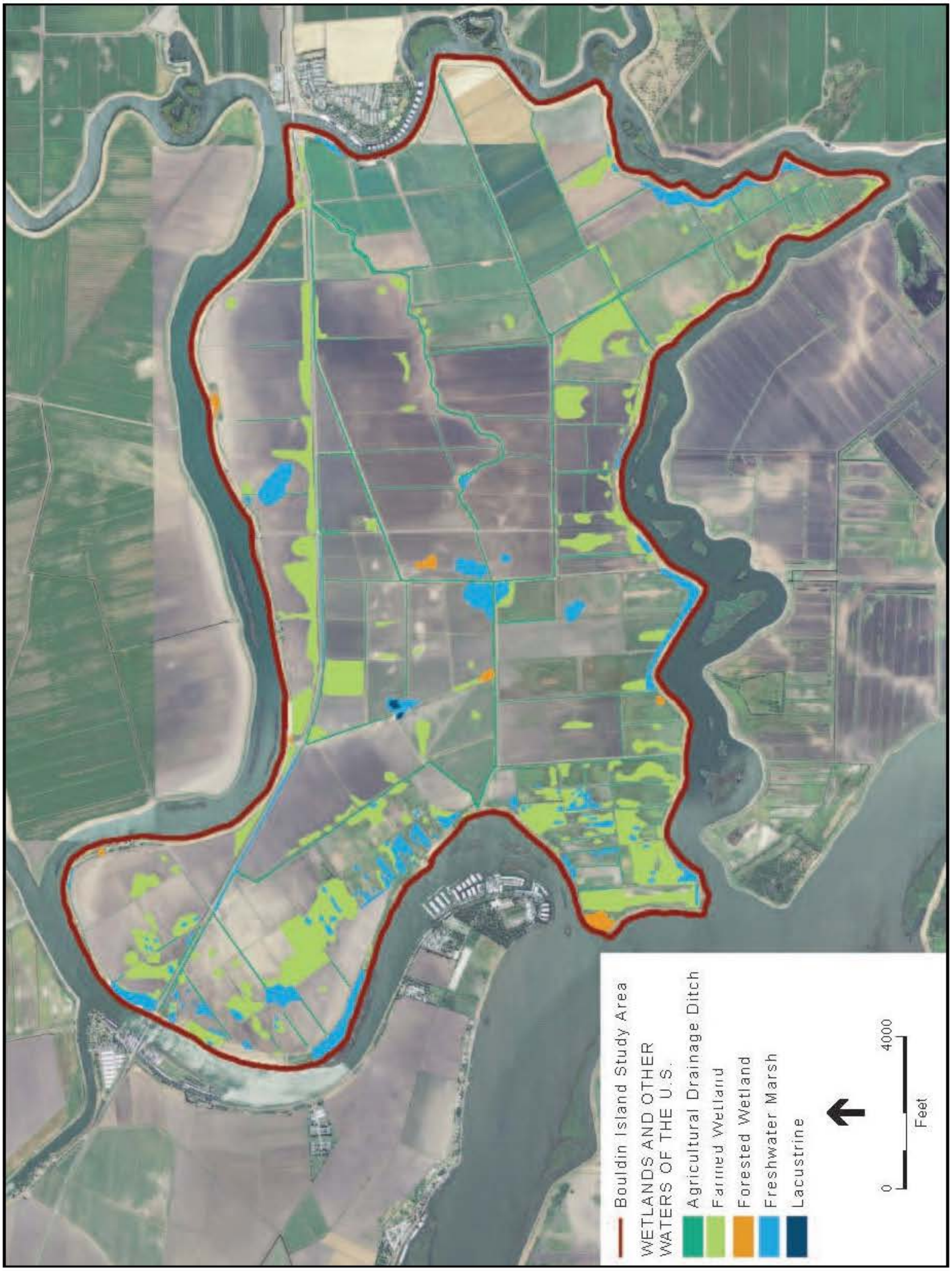
Sources: USDA 2012, Environmental Science Associates 2013

Exhibit 3.4-1 **Bacon Island Wetlands**

Exhibit 3.4-2 **Webb Tract Wetlands**

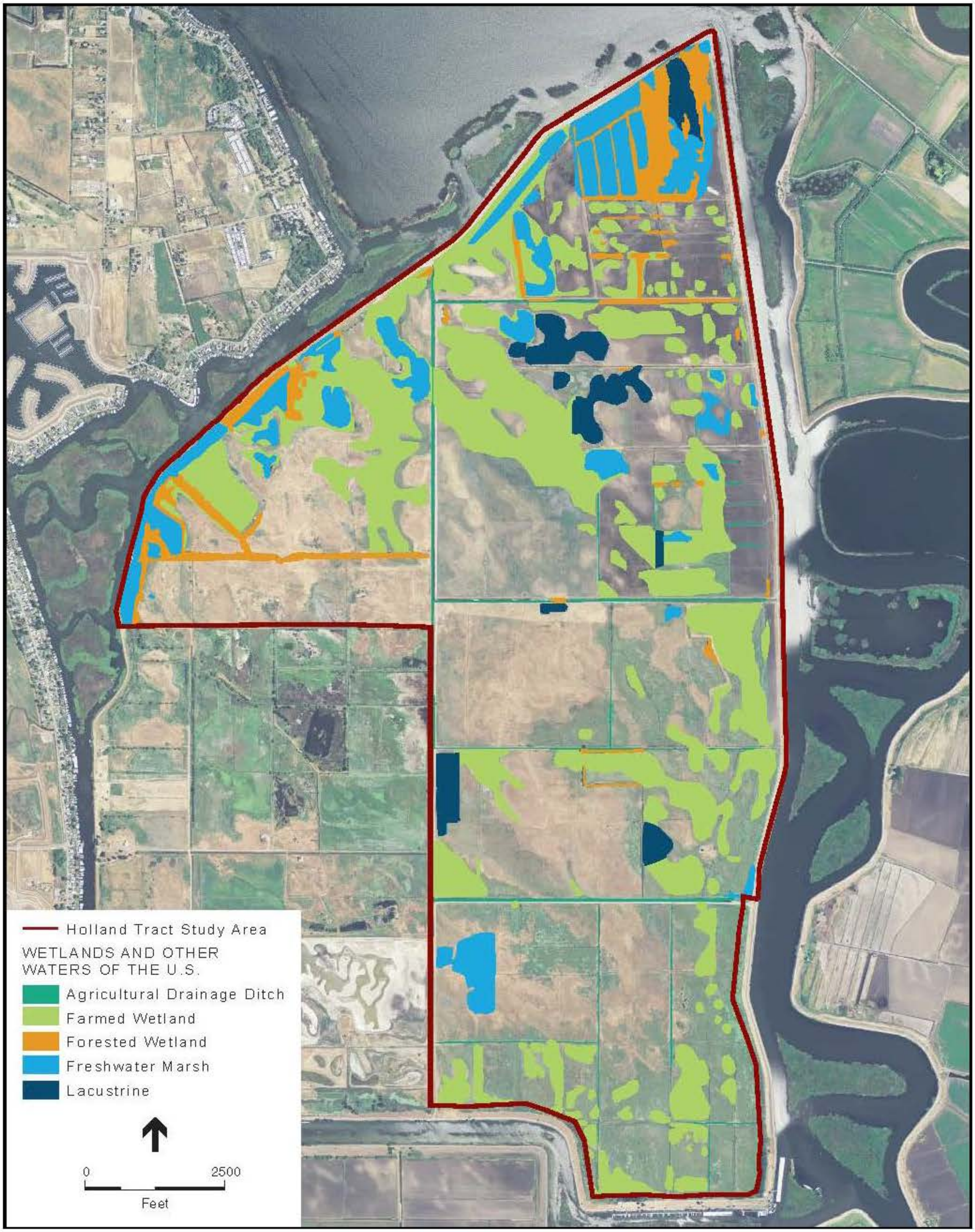


Sources: USDA 2013, Environmental Science Associates 2013



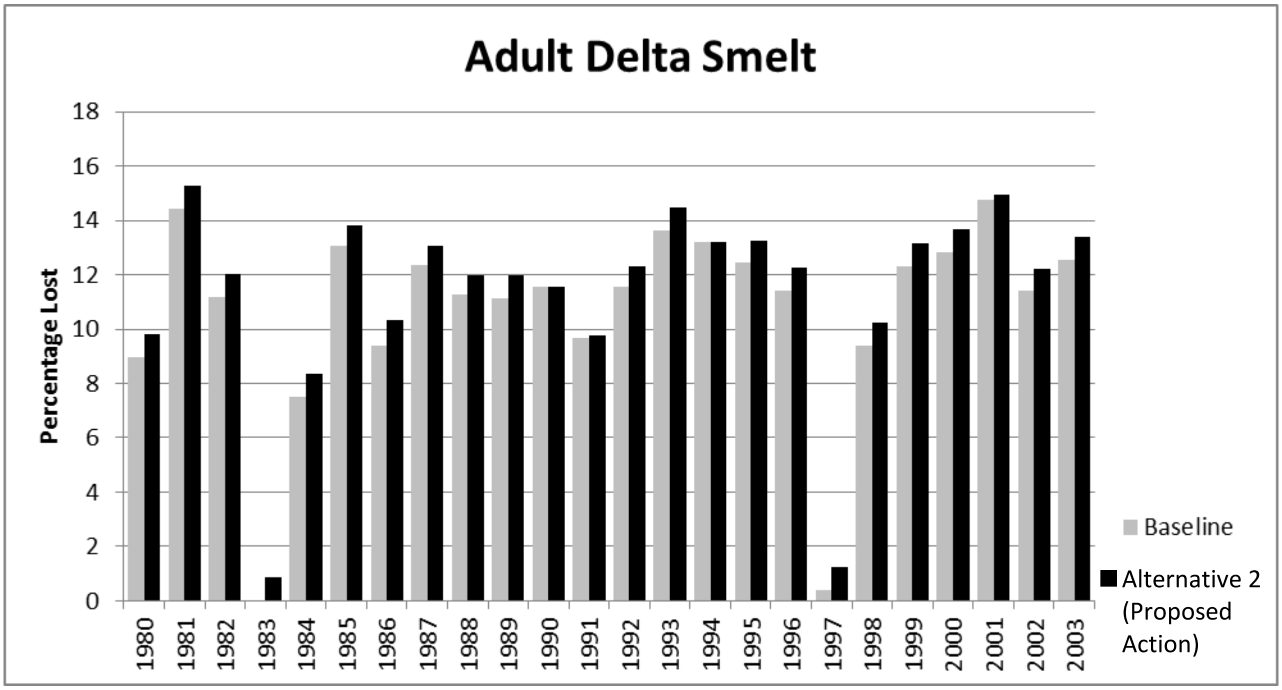
Sources: USDA 2013, Environmental Science Associates 2013

Exhibit 3.4-3 **Bouldin Island Wetlands**



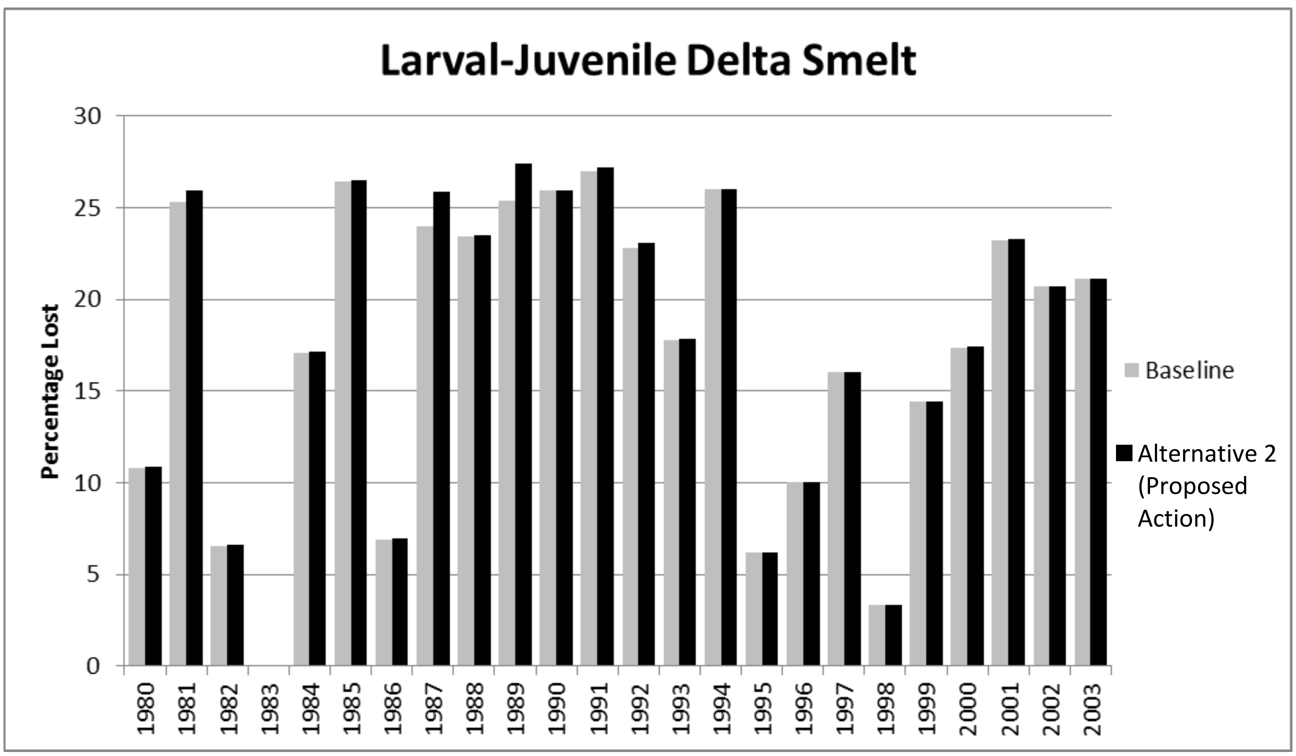
Sources: USDA 2012, Environmental Science Associates 2013

Exhibit 3.4-4 **Holland Tract Wetlands**



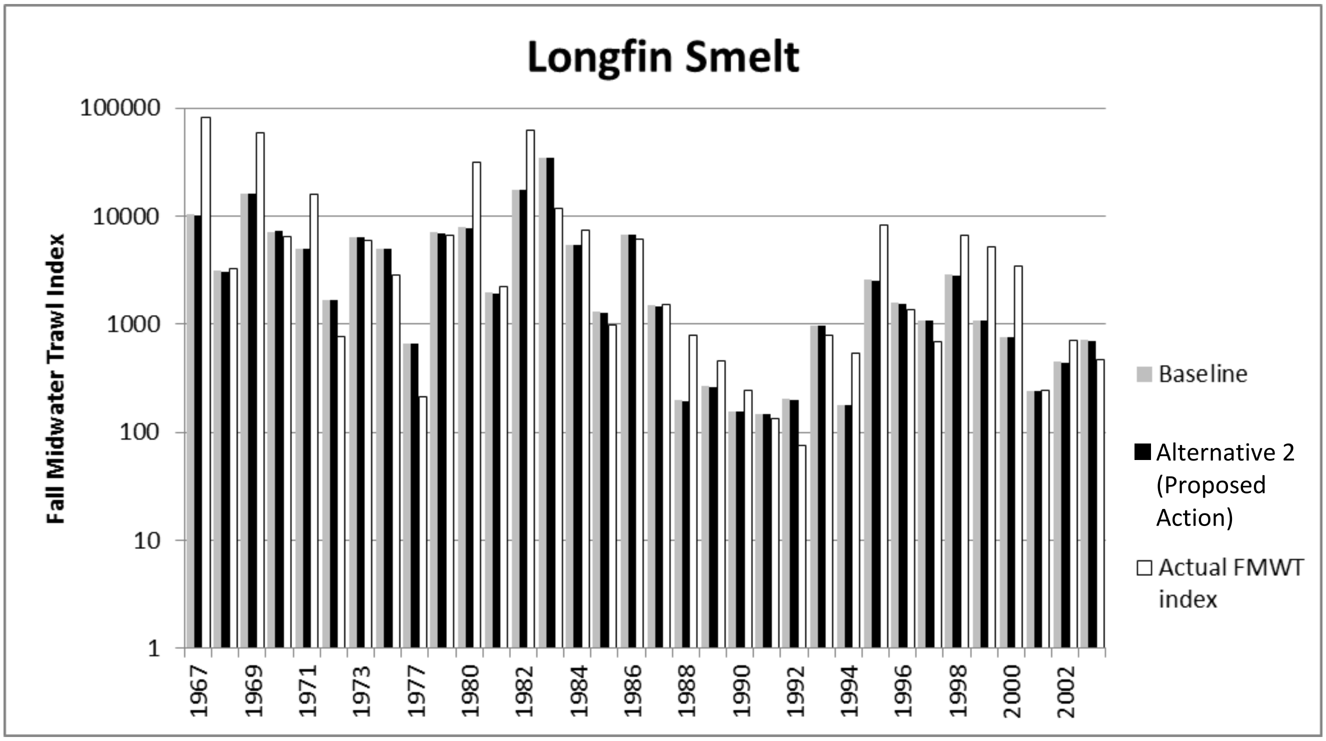
Sources: ICF 2010:4.5-85; U.S. Fish and Wildlife Service (2008:212); adapted by Environmental Science Associates in 2013

Exhibit 3.4-5 **Percentage of Adult Delta Smelt Lost to Entrainment at the SWP/CVP Export Facilities, Based on a Predictive Equation Described by U.S. Fish and Wildlife Service**



Sources: ICF 2010:4.5-86; U.S. Fish and Wildlife Service (2008:220); adapted by Environmental Science Associates in 2013

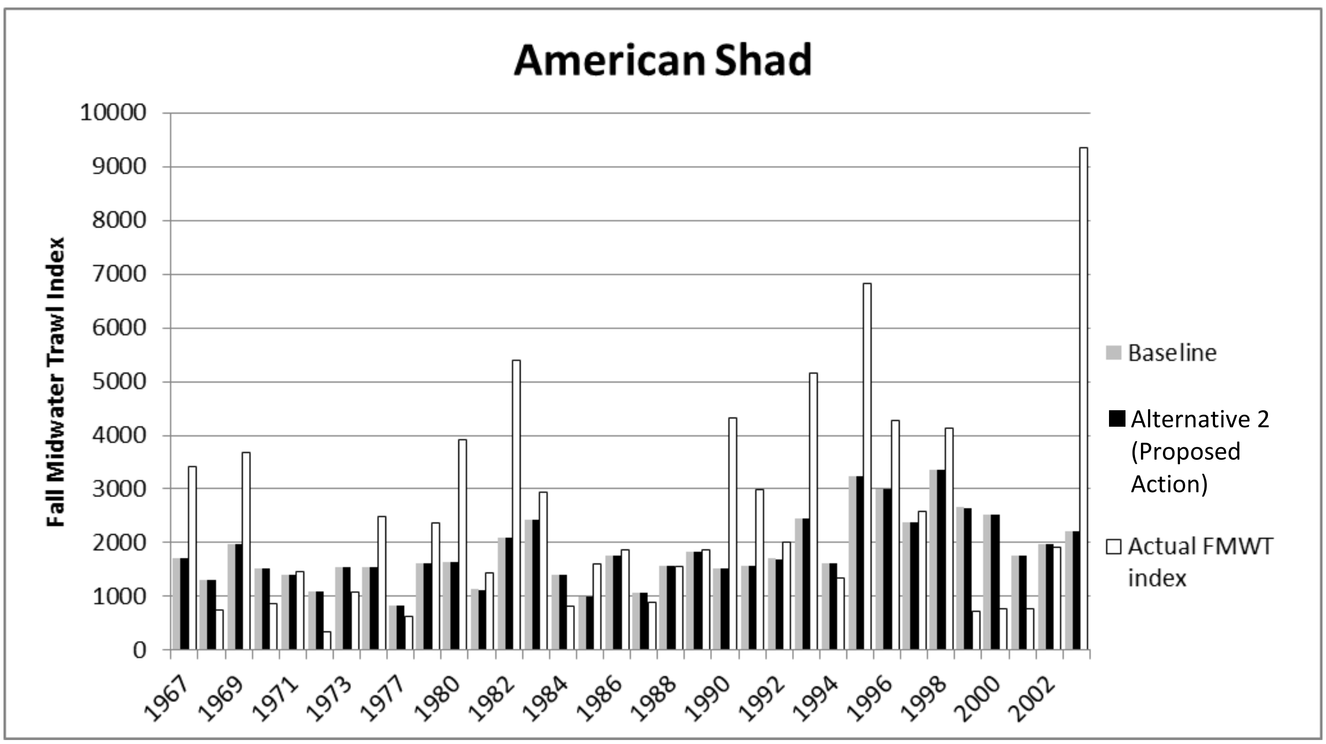
Exhibit 3.4-6 **Percentage of Larval-Juvenile Delta Smelt Lost to Entrainment at the SWP/CVP Export Facilities, Based on a Predictive Equation Described by U.S. Fish and Wildlife Service**



Note: logarithmic y axis scale

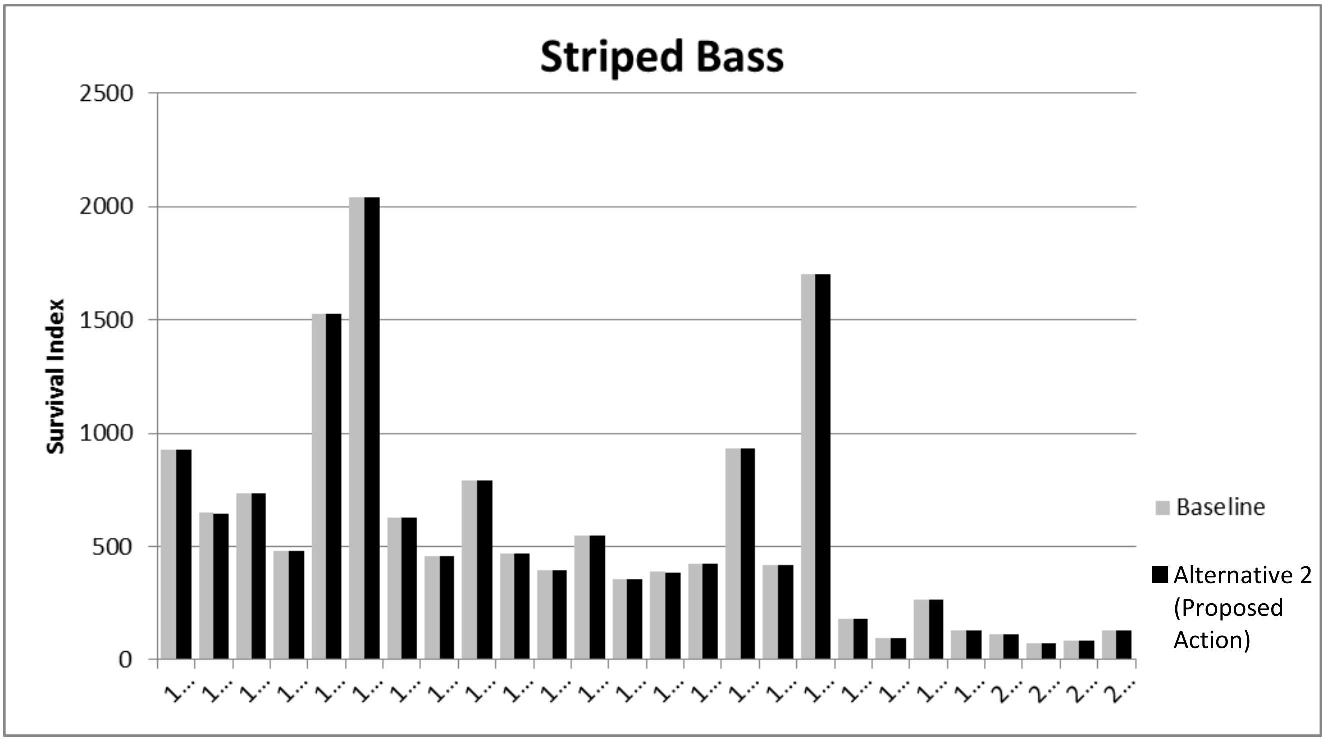
Sources: ICF 2010:4.5-92; Kimmerer et al. 2009; adapted by Environmental Science Associates in 2013

Exhibit 3.4-7 Fall Midwater Trawl Indices of Longfin Smelt under Baseline and Alternative 2 (Proposed Action), as Estimated from a Regression of FMWT Against X2



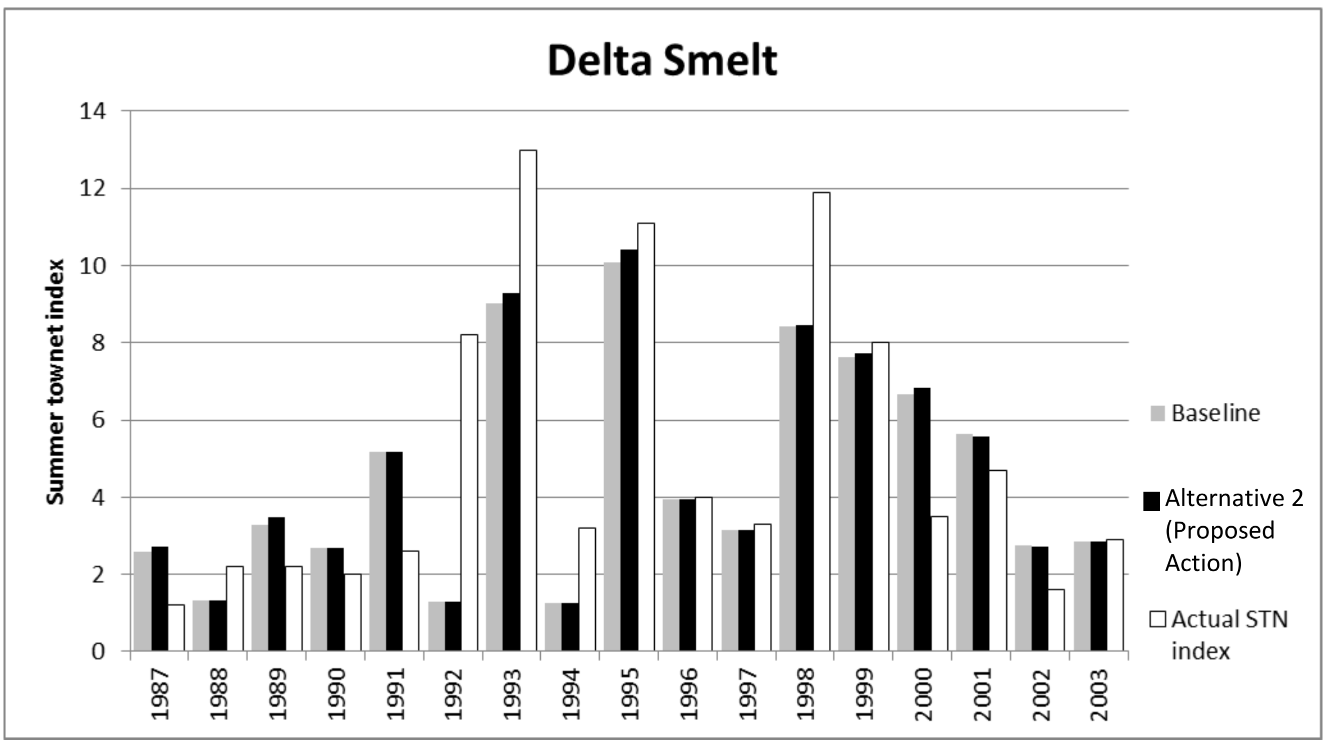
Sources: ICF 2010:4.5-93; Kimmerer et al. 2009; adapted by Environmental Science Associates in 2013

Exhibit 3.4-8 Fall Midwater Trawl Indices of American Shad under Baseline and Alternative 2 (Proposed Action), as Estimated from a Regression of FMWT Against X2



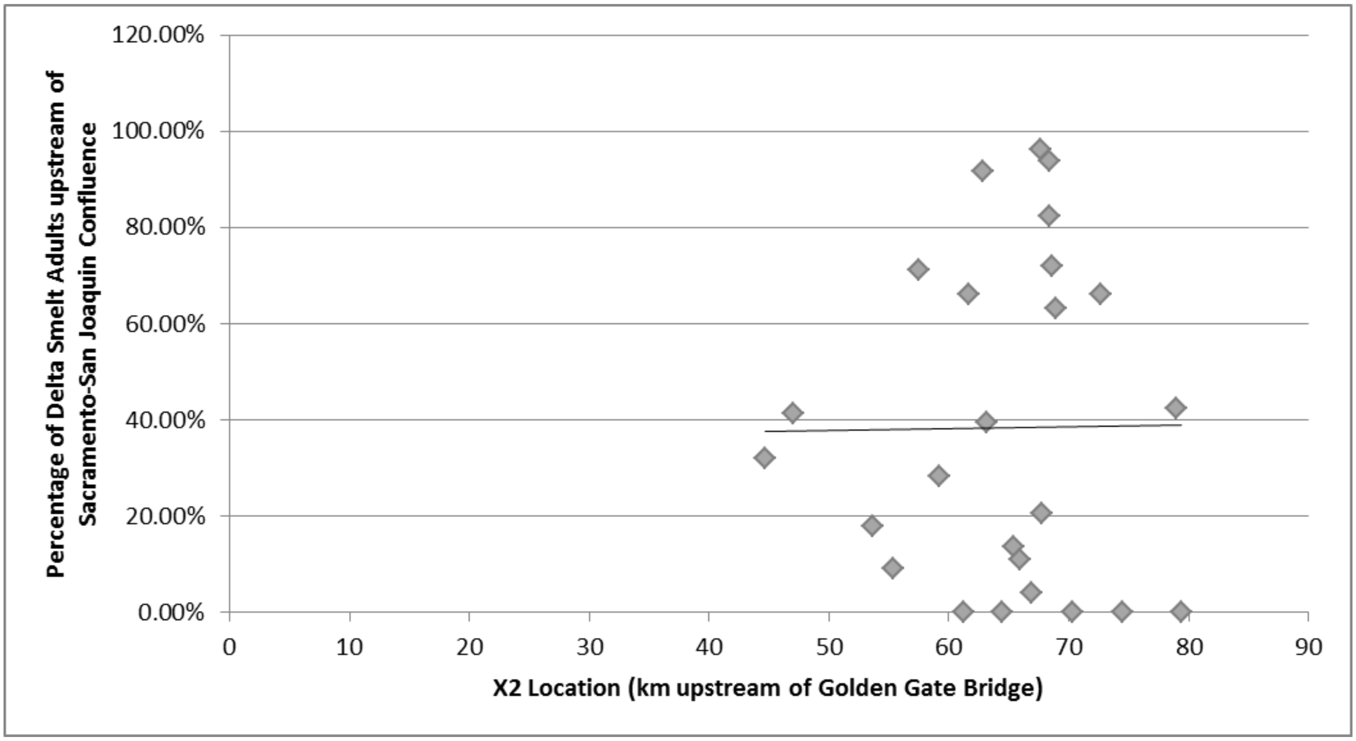
Sources: ICF 2010:4.5-94; Kimmerer et al. 2009; adapted by Environmental Sciences Associates in 2013

Exhibit 3.4-9 Survival Indices of Striped Bass under Baseline and Alternative 2 (Proposed Action), as Estimated from a Regression of Survival Index Against X2



Source: ICF 2010:4.5-95; adapted by Environmental Science Associates in 2013

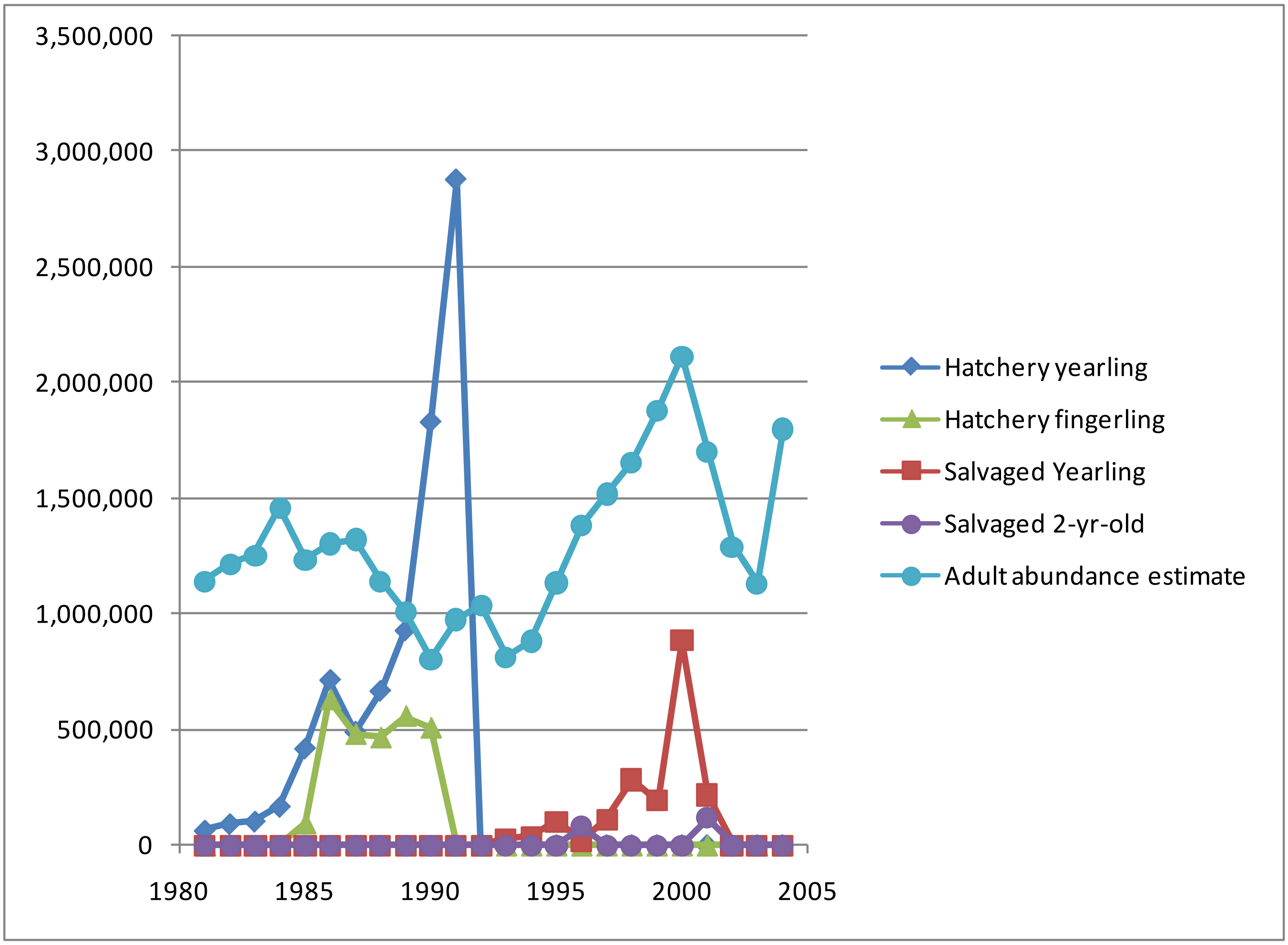
Exhibit 3.4-10 Summer Townet Indices of Delta Smelt under Baseline and Alternative 2 (Proposed Action), as Estimated from a Regression of Summer Townet Index versus Fall Midwater Trawl Index and X2 Position



Note: A trendline is shown to demonstrate the lack of a relationship. Values are monthly estimates based on extrapolations of total abundance from spring Kodiak trawling (January to May 2002 to 2007) and do not include regions beyond the main transect (Montezuma Slough, the Sacramento River, and Cache Slough).

Source: ICF 2010:4.5-96; adapted by Environmental Science Associates in 2013

Exhibit 3.4-11 Percentage of Delta Smelt Adults along an Estuarine Transect from Carquinez Strait to the Delta Upstream of the Sacramento–San Joaquin Confluence



Note: Adult abundance estimates for 1995, 1997, 1999, and 2001 were interpolated from adjacent years.

Source: Gingras 2008

Exhibit 3.4-12 **Releases of Hatchery-Reared and Salvaged Striped Bass into the Greater San Francisco Bay Watershed, with Estimates of Adult Abundance, 1981–2004**

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3.5 BIOLOGICAL RESOURCES

3.5.1 INTRODUCTION

This section describes recent changes to the existing environmental conditions and regulatory setting of the project area, summarizes the unchanged affected environment, and describes changed environmental effects related to terrestrial vegetation and wildlife resources (herein referred to as “biological resources”) for the project. This section contains a review and update of the 1995 DEIR/EIS biological resources effects assessment, which was incorporated by reference in the 2001 FEIS (Chapters 3G and 3H). The effects to biological resources were analyzed most recently in Sections 4.6 and 4.7 and Chapter 5 of the 2010 DEIR, which also served as a basis for this analysis and are herein incorporated by reference. Updates include results from surveys for special-status plants and wildlife and an analysis of potential effects from invasive plants. In addition, as described in Section 3.4, “Aquatic Resources” of this SEIS, an updated wetland delineation was completed in 2012 and verified by USACE (Environmental Science Associates 2012). The delineation also included updated descriptions for vegetation communities and wildlife habitat types, which are herein incorporated by reference.

The 2001 FEIS concluded that the Proposed Action and alternatives under consideration would affect vegetation and wildlife resources on and in the vicinity of the four project islands. Most effects were associated with the loss of existing habitats (primarily agricultural) on the Reservoir Islands, and the creation or enhancement of habitat on the Habitat Islands (for Alternatives 1 and 2 [Proposed Action]). Since that time, there have been changes in the affected environment and regulatory setting. However, there have been no changes in the project alternatives that result in new significant environmental effects or a substantial increase in the severity or intensity of previously identified significant effects on biological resources. Despite some changes to circumstances and current information, the overall project effects remain consistent with those discussed in the 2001 FEIS.

This biological resources analysis has been updated to reflect the environmental conditions on and around the project islands. In particular, new effects are identified for giant garter snake (*Thamnophis gigas*), Swainson's hawk (*Buteo swainsoni*), and greater sandhill crane (*Grus canadensis tabida*). In addition, the Draft Compensatory Mitigation Plan (CMP) included in the 2001 FEIS was supplemented with a Draft Compensatory Mitigation Plan and Conceptual Restoration Plans for the Habitat Islands (Environmental Science Associates 2015) collectively referred to as the Draft CMP and included as Appendix B to this SEIS. These plans update the amount and types of habitat creation and enhancement that would occur on the Habitat Islands under Alternatives 1 and 2. Implementation of these plans under Alternatives 1 or 2 would result in a net increase in freshwater marsh, cottonwood-willow, Great Valley willow scrub, and permanent pond habitats on the Habitat Islands.

The project would not have any direct effects on biological resources in the places of use; the effects on biological resources, if any, associated with the provision of project water to the places of use are addressed in the “Secondary and Cumulative Effects” subsection below and in Chapter 4, “Other Statutory Requirements.”

SUMMARY OF PROJECT CHANGES, NEW CIRCUMSTANCES AND NEW INFORMATION

Substantial Changes in the Project

Since the 2001 FEIS was completed, there have been no substantial changes in the project resulting in new significant effects or a substantial increase in the severity or intensity of effects on biological resources. Changes in the levee design would result in minor changes in effects to vegetation and wildlife. Circumstances surrounding project alternatives are similar to the previous document, though there have been some changes in the listing status for some species, regulatory changes, and the development of Habitat Conservation Plans in the region. Finally, the project no longer includes a proposal to construct new recreation facilities on the Reservoir or Habitat Islands; however, this change does not affect the analysis of biological resources.

New Circumstances

Two species addressed in the 2001 FEIS, bald eagle (*Haliaeetus leucocephalus*) and cackling (Aleutian Canada) goose (*Branta hutchinsii leucopareia*), have been removed from listing under the Federal Endangered Species Act (ESA). The bald eagle is addressed in this analysis because it is listed by the state as a threatened species and is also protected by the Bald and Golden Eagle Protection Act. The cackling goose, by contrast, has no other state or Federal listing status, and therefore is not considered further in this analysis. Valley elderberry longhorn beetle (VELB) (*Desmocerus californicus dimorphus*) has been proposed for delisting under the ESA but no decision has been made and the species remains Federally listed as threatened as to the time of this writing.

Executive Order (EO) 13112, signed on February 3, 1999, calls for the prevention and control of invasive species by Federal agencies and on Federal actions. To comply with EO 13112, this analysis identifies an additional effect related to invasive species that was not identified in the 2001 FEIS. This addition is not considered a substantial change from the previous analysis based on the consideration that long-term management of compensation habitats, as outlined in the Draft CMP, focuses on maintaining and improving wetlands and wildlife habitats. Because invasive species can have adverse effects on the establishment and function of wetlands and wildlife habitats, management of species that pose a threat to created and enhanced habitat, or to the greater Delta ecosystem, is implicit to these plans and criteria. It should also be noted that ongoing agricultural practices target the management and eradication of invasive weed species.

The San Joaquin Multi-Species Conservation Plan (SJMSCP) was adopted in 2001 and covers all of San Joaquin County. Permit holders under the SJMSCP include the County; the cities of Escalon, Lodi, Manteca, Stockton, Lathrop, Ripon, and Tracy; the San Joaquin Council of Governments; and others. The SJMSCP is designed to provide a regional approach to mitigating development effects on the 97 listed and non-listed plant, fish, and wildlife species covered by the SJMSCP and compensating for the conversion of open space to non–open space uses. The plan provides compensation for habitat losses through collection of fees that are used to preserve habitats elsewhere. The SJMSCP is not addressed further in this analysis because the applicant’s project is not a covered activity and is not subject to the SJMSCP.

The East Contra Costa County Habitat Conservation Plan/Natural Community Conservation Plan (ECCCHCP/NCCP) was adopted in January 2008. Permit holders under the ECCCHCP/NCCP include the County; the cities of Brentwood, Clayton, Oakley, and Pittsburg; and Contra Costa County Flood Control and Water Conservation District and the East Bay Regional Park District. The ECCCHCP/NCCP is designed to provide a regional approach to mitigating housing, transportation, and growth effects on the 28 covered species. The plan provides compensation for habitat losses through collection of fees that are used to preserve and restore habitats and natural communities in the County as well as a framework to pursue other conservation efforts in the County. It does not include Sacramento-San Joaquin Delta (Delta) lands and therefore does not affect the applicant’s project.

The Bay Delta Conservation Plan (BDCP) is currently in preparation. The BDCP is a plan to provide for the recovery of endangered, threatened, and sensitive species and their habitats in the Delta in a way that also will protect and restore water supplies. The BDCP will identify and implement conservation strategies to improve the overall ecological health of the Delta; identify and implement ecologically friendly ways to move freshwater through and/or around the Delta; address toxic pollutants, invasive species, and impairments to water quality; and provide a framework and funding to implement the plan over the next 50 years.

A multitude of state and Federal water projects would be covered under the BDCP; each project would be included in the streamlined permitting process and comprehensive Delta-wide restoration program. However, BDCP is still in the Draft EIR/EIS stage, and has substantial technical, legal, political, and financing hurdles to overcome prior to implementation. Therefore, its full implementation is speculative at present. Furthermore, if approved, the creation of habitat would take place over a 50-year time period, therefore, it is provided for informational purposes only.

New Information

The primary sources of data and information used to update the environmental setting for this SEIS include:

- Updated, verified wetland delineation for the project (SPK-1901-09804; Environmental Science Associates 2012).
- A California Natural Diversity Database (CNDDB) records search within a 5-mile radius of the project islands, which included Woodward Island, Brentwood, Bouldin Island, Jersey Island, Rio Vista, Isleton, Thornton, Terminous, and Holt U.S. Geological Survey (USGS) 7.5-minute quadrangles (California Department of Fish and Wildlife 2013).
- A U.S. Fish and Wildlife Service (USFWS) species list (dated April 2013) of endangered, threatened, and candidate species for the Woodward Island, Brentwood, Bouldin Island, Jersey Island, Rio Vista, Isleton, Thornton, Terminous, and Holt USGS 7.5-minute quadrangles (U.S. Fish and Wildlife Service 2010).
- A California Native Plant Society Rare Plant Inventory search (March 2015) for the Woodward Island, Brentwood, Bouldin Island, Jersey Island, Rio Vista, Isleton, Thornton, Terminous, and Holt USGS 7.5-minute quadrangles (California Native Plant Society 2015).
- In-Delta Storage Program Draft Feasibility Study Report on Environmental Evaluations (California Department of Water Resources 2003).
- 2006 Supplemental Report to the 2004 Draft Feasibility Study In-Delta Storage Project (California Department of Water Resources 2006).

Vegetation information in the 2001 FEIS was based on 1988 conditions. Since 1988, the types and distribution of crops and distribution of wetlands on the project islands have continued to change in response to market conditions and ecological circumstances. Recent crop data (2011), information from California Department of Water Resources (DWR) surveys (California Department of Water Resources 2003), aerial photo interpretation, and updated wetland mapping were used to update the description of existing conditions and make corresponding revisions to the effects analysis. In addition, the classification of vegetation types was updated to reflect the California Department of Fish and Wildlife's (DFW's) publication *A Guide to Wildlife Habitats* (Mayer and Laudenslayer 1988), and the actual acreage of each wildlife habitat type was updated. Other changes related to habitat classification include the identification of a new wetland habitat type, farmed wetlands. These new circumstances were used to determine the baseline conditions for assessing the effects of the Proposed Action and alternatives under consideration.

New information regarding the presence of special-status plants and wildlife in the project area was obtained through surveys conducted by DWR during 2002–2003 and through a search of the current version of the CNDDB (California Department of Fish and Wildlife 2013). In addition, updated lists of threatened and endangered species that may occur in the project area were obtained from the USFWS website (U.S. Fish and Wildlife Service 2010). Using this information, discussions and subsequent effect conclusions for several special-status species have been updated in this section.

Within the 2001 FEIS, it was concluded that only marginal habitat for giant garter snake was present on the Reservoir Islands; however, following a sighting of the species on Webb Tract in 2002, DWR initiated species-specific surveys led by Eric Hanson to collect site-specific data on occurrence of giant garter snake on the Reservoir Islands (California Department of Water Resources 2003). Subsequent results and findings of those focused surveys have been incorporated into this section. Species-specific surveys were also performed for greater sandhill crane (California Department of Water Resources 2003), and subsequent findings for that species have also been incorporated into this document.

Special-status plant surveys were conducted in 1988 and 1994 by ICF and in 2002 by DWR. Over 100 populations of Mason's lilaeopsis (*Lilaeopsis masonii*), a species state-listed as rare, were observed on the exterior levee slopes of Bacon Island, Webb Tract, Bouldin Island, and Holland Tract. No other Federal- or state-listed plants were observed during these surveys.

SUMMARY OF ENVIRONMENTAL COMMITMENTS

Environmental commitments are measures incorporated by the project applicant as part of the project, meaning they are proposed as elements of the Proposed Action and are therefore considered in conducting the environmental analysis for each resource area of this SEIS. The purpose of environmental commitments is to reflect and incorporate best practices into the project that avoid, minimize, reduce, or offset potential adverse environmental effects. A complete description of the environmental commitments that have been incorporated into the project since the 2001 FEIS is contained in Chapter 2, "Project Description and Alternatives," of this SEIS.

A number of environmental commitments related to vegetation and wildlife originated in a Draft CMP originally developed in 1995 (ICF 1995) and have been incorporated into the project. Current commitments are detailed in the Draft CMP more recently prepared for the project in 2015 (Environmental Science Associates 2015). The Draft CMP (Appendix B) includes Conceptual Restoration Plans for the Habitat Islands and was designed to supplement and update environmental commitments related to compensatory mitigation earlier described in the Draft CMP. These plans would be combined into a Final CMP, once final permit conditions from USACE, USFWS, National Marine Fisheries Service (NMFS), and DFW are received.

An environmental commitment originally described in the 2010 DEIR calls for invasive plant management goals and measures to be included in the Final CMP. Adaptive management would be the main approach with a focus on prevention and early detection of new invasive plant infestations. This measure is now included as an environmental commitment in the project description as a direct response to EO 13112 (which requires prevention and control of invasive plants by Federal agencies and on Federal actions).

As summarized in Chapter 2, "Project Description and Alternatives," a Construction Implementation Plan would be developed once construction plans, specifications, and schedule are determined, and would include:

- measures for avoiding elderberry shrubs on Holland Tract during habitat creation;
- specifications for clearly marking construction areas to minimize disturbance of riparian areas;
- preconstruction surveys and best management practices to minimize effects to special-status reptiles; and
- preconstruction surveys to locate and establish buffers around nests of special-status birds.

A report would be submitted to DFW upon the completion of construction that would describe the success of construction effects avoidance measures.

Effects related to habitat loss for the Federal- and state-listed threatened giant garter snake (*Thamnophis gigas*) and state-listed threatened Swainson's hawk (*Buteo swainsoni*) would be compensated through the creation and enhancement of reproductive and foraging habitat on the Habitat Islands under Alternatives 1 and 2, as outlined in the Draft CMP. These compensation components are considered environmental commitments, and are part of the project.

3.5.2 AFFECTED ENVIRONMENT

REGIONAL SETTING

The project area is located in the Great Valley ecological region (Miles and Goudy 1997). The Great Valley of California is a vast, flat, low-lying plain almost entirely surrounded by mountains. The valley parallels the general north-south trend of the Sierra Nevada mountains on the east and the California Coast ranges on the west. The northern half of the Central Valley is known as the Sacramento Valley, and the southern half is known as the San Joaquin Valley. The project area is located in the northern San Joaquin Valley within basin-type physiography. Basins are common in the San Joaquin Valley, and are commonly associated with hardpans and high clay content (McElhiney 1992). The region has a Mediterranean climate with hot, dry summers, where average highs are in the mid to upper 90's contrasted by cool, but relatively mild wet winters with temperature averages ranging from mid-30's to low 60's. The mean annual precipitation, which falls primarily as rain, is about 16 to 18 inches. Mean annual temperature is about 59 to 62 degrees Fahrenheit. The mean freeze-free period is about 250 to 275 days (Miles and Goudy 1997).

The Delta contains a mix of land uses and habitats, with upland areas primarily dominated by agricultural land uses. Rural residential, recreational, and infrastructure (roadways, energy development, water supply facilities, and other utility structures) also occur in the region. Both aquatic and upland habitats in the Delta have been heavily modified by these and other activities over the past 150 years; as a result, some ecosystem functions are either impaired or are declining (Whipple et al. 2012). Furthermore, the farming of islands in the Delta has resulted in many islands to become subsided or lose topsoil, because peat no longer is generated through the decomposition of vegetation and wind scours the exposed soils. All of the islands within the project area exhibit varying levels of subsidence, with most areas exhibiting elevations that are substantially below sea level.

VEGETATION COMMUNITIES AND WILDLIFE HABITATS

Vegetation communities are assemblages of plant species that occur together in the same area. They are defined by species composition and relative abundance. In this updated evaluation, DFW's publication *A Guide to Wildlife Habitats* (Mayer and Laudenslayer 1988) was used to define wildlife habitats, with the classification from the 2001 FEIS included in parentheses where appropriate. Habitat assessments and mapping were first completed in December 1987 and were subsequently updated in 2008. In addition, wetlands and other waters of the U.S. were classified in 2012 in support of the updated wetland delineation. The types of wildlife habitats present are shown in Table 3.5-1 and Exhibits 3.5-1 through 3.5-4. It should be noted that like most islands used for agricultural practices in the Delta, the composition and quantity of upland habitats is subject to change in any given season based on the types of crops planted and the hydrologic and land management regime used to grow them (for example, some areas may be flooded to accommodate a crop one year, then left dry the next). For this reason, the summary of acreages and habitat types found in this section are a snapshot, and should be viewed as a description of "typical" conditions at this time.

There are 11 types of habitat on the project islands. Of these, four are upland habitats: perennial grassland, cropland, fallow, and urban/disturbed. Another seven habitat types are aquatic: freshwater marsh, farmed wetlands, forested wetlands (cottonwood-willow and Great Valley willow scrub), canals/ditches, permanent pond, tidal channel, and tidal marsh. Each habitat type is discussed in greater detail below.

Upland Plant Communities

Herbaceous Upland

Perennial Grassland

Perennial grassland occurs on all four project islands, generally growing adjacent to agricultural fields and along levee slopes (located around the perimeter of each island). Typical perennial grassland habitat supports native perennial species such as California oatgrass (*Danthonia californica*) and red fescue (*Festuca rubra*). However, on the project islands this habitat is dominated by three major nonnative perennial grass species—Bermuda grass (*Cynodon dactylon*), Italian ryegrass (*Festuca perennis*), and Johnson grass (*Sorghum halepense*)—which form dense patches throughout drier upland areas.

Table 3.5-1 Vegetation Communities and Wildlife Habitats on the Project Islands						
	Reservoir Islands		Habitat Islands			
Habitat Type	Bacon Island (Acres)	Webb Tract (Acres)	Bouldin Island (Acres)	Holland Tract (Acres)	Total (Acres)	Percent of Total Acreage
Upland Communities						
Perennial grassland	385.7	762.8	683.6	150.0	1,982.2	10
Cropland	4,469.6	3,045.4	4,558.5	0	12,073.5	60
Fallow	0	57.4	0	1,934.0	1,991.4	10
Urban/disturbed	156.0	33.3	73.9	0	263.2	1
Aquatic Communities						
Freshwater marsh	116.9	159.0	144.8	166.5	587.1	3
Farmed wetland	406.5	1,100.5	495.0	625.2	2627.1	13
Cottonwood-willow[1]	8.8	112.2	2.2	89.4	91.6	<0.5
Great Valley willow scrub[1]	9.2	91.7	10.5	22.0	32.4	<0.5
Tidal marsh	0.8	0.2	0	0	0.9	<0.5
Canals/ditches	27.2	33.6	45.7	18.3	124.7	1
Permanent Pond	0.2	83.3	1.0	75.0	159.5	1
Tidal channel	3.1	3.2	0	0	6.4	<0.5
Total	**5,584.0**	**5,482.6**	**6,015.1**	**3,080.3**	**20,162.0**	**100**

Note:
[1] Cottonwood-willow and Great Valley willow scrub are both "forested wetland" and are mapped and described together as the forested wetland type.
Sources: Data compiled by ICF in 2010 and Environmental Science Associates in 2013

Perennial grassland may support various bird, invertebrate, amphibian, and reptile species, which may use this habitat for foraging, cover, and/or breeding. Common wildlife species that may use this habitat include common garter snake (*Thamnophis sirtalis*), Pacific chorus frog (*Pseudacris regilla*), and black Phoebe (*Sayornis nigricans*).

Developed Uplands

Cropland and Fallow

Land use in the vicinity is dominated by agriculture, including the project islands. The main crops currently grown on Bacon Island, Webb Tract, and Bouldin Island are corn and alfalfa. Minor crops include grains and seeds such as wheat, rice, oats, and sunflowers, although row crops such as tomato are also grown to a lesser extent. Holland Tract is grazed by cattle, and historic management included fencing, vegetation management (for forage), and other grazing management activities. In more recent years, corn has also been planted on Holland Tract.

Cropland and fallow habitat may be used by a variety of common wildlife, such as killdeer (*Charadrius vociferus*), barn swallow (*Hirundo rustica*), American crow (*Corvus brachyrhynchos*), American pipit (*Anthus rubescens*), savannah sparrow (*Passerculus sandwichensis*), California ground squirrel (*Otospermophilus beecheyi*), Botta's pocket gopher (*Thomomys bottae*), and California meadow vole (*Microtus californicus*). Some varieties of crops also provide foraging habitat for sensitive wildlife species, including Swainson's hawk (*Buteo swainsoni*) and burrowing owl (*Athene cunicularia*).

Urban/Disturbed

Urban/disturbed habitats are developed sites that are dominated by plant species introduced by humans and are established or maintained by human disturbances or activities (Holland and Keil 1990). Some are entirely artificial, such as areas influenced by urban or suburban landscaping or plantings. On such sites, the native vegetation has typically been removed by clearing in preparation for landscaping or development. Urban habitat are present along the paved and unpaved roadways, as well as around the perimeters of the structures present on all of the four project islands, which include rural residences and associated farmstead structures, rural airstrips, agricultural structures, and equipment complexes. Vegetation structure varies from lawns with scattered shade trees to mature mixed canopy consisting of ornamental and native species. Native and ornamental plants observed around urban areas included eucalyptus (*Eucalyptus* spp.), common fig (*Ficus carica*), Himalayan blackberry (*Rubus armeniacus*), and Freemont cottonwood (*Populus fremontii*), among others.

Native and introduced wildlife species that are tolerant of human activities often occur in urban habitats. Urban land use components, such as buildings and domestic landscaping, provide habitat for some wildlife species. For example, common birds such as house finch (*Carpodacus mexicanus*) build their nests on structures, and less abundant species like black phoebe, cliff swallow (*Hirundo pyrrhonota*), and barn swallow, also use buildings, especially near water. Common wildlife such as killdeer, American robin (*Turdus migratorius*), and American pipit (*Anthus rubescens*) are likely to use urban/disturbed habitat. Mammals such as opossum (*Didelphis virginiana*), raccoon (*Procyon lotor*), striped skunk (*Mephitis mephitis*), Botta's pocket gopher, Norway rat (*Rattus norvegicus*), and house mouse (*Mus musculus*) are common in urban/disturbed habitats. Older farm structures, such as barns and stables, may also provide suitable roosting and maternity sites for bats, including pallid bat (*Antrozous pallidus*), Mexican free-tailed bat (*Tadarida brasiliensis*), and yuma myotis (*Myotis yumanensis*).

Aquatic Plant Communities and Habitats

Freshwater Marsh

Freshwater marsh is generally characterized by erect, rooted herbaceous hydrophytes and may occur in association with terrestrial or aquatic habitats such as riverine, lacustrine, and wet meadows. Dominant vegetation generally consists of perennial monocots such as cattail (*Typha latifolia*) and rushes (*Juncus* spp.). On the project islands, freshwater marsh is generally found adjacent to agricultural drainage ditches, in expansive pockets near island perimeters, and around the perimeter of the three blowout ponds (described below under the "Permanent "Pond Habitat" subsection).

Wildlife using the freshwater marsh largely includes wading birds and waterfowl species such as great blue heron (*Ardea herodias*), great egret (*Ardea alba*), American coot (*Fulica americana*), and mallard (*Anas platyrhynchos*). Red-winged blackbirds (*Agelaius phoeniceus*), and aquatic reptiles and amphibians such as garter snake (*Thamnophis* sp.), pond turtle (*Clemmys marmorata*), and Pacific chorus frog (*Pseudacris regilla*) also use this habitat.

Farmed Wetland

"Farmed wetland" is a project-specific vegetation description for areas that are either fallow agricultural fields containing dense stands of exotic herbaceous weeds (as in the case for many areas on Holland Tract) or are actively cultivated fields that exhibit standing water during the late winter and early spring months, after the majority of the water has been pumped off of the islands (i.e., after the "draw-down" of flooded fields). Farmed wetland communities are more commonly found near the edges of agricultural fields and along smaller lateral drainage canals. The depth of the water table and the condition of the agricultural drainage system in close proximity to each location determines whether ponded water is present in the fields after the draw-down period. On the project islands, this habitat type includes species such as annual smartweed (*Persicaria pensylvanica*), peppergrass (*Lepidium nitidum*), amaranth (*Amaranthus deflexus*), wild radish (*Raphanus sativus*), nettle (*Urtica dioica* ssp. *holosericea*), cocklebur (*Xanthium strumarium*), watergrass (*Echinochloa* sp.), and planted crops, such as corn and rice.

Wildlife associated with farmed wetland habitats is similar to that associated with cropland/fallow habitats, but depends on the crop planted. This vegetation may be too dense to provide adequate foraging habitat for raptors. It provides ideal foraging habitat for seed-eating birds such as ring-necked pheasant (*Phasianus colchicus)*, savannah sparrow, white-crowned sparrow (*Zonotrichia leucophrys*), and house finch.

Forested Wetland

Forested wetland habitat occurs on the project islands in association with year-round water sources, including some agricultural drainages, wetland areas, and permanent ponds. This habitat type includes cottonwood-willow and Great Valley willow scrub vegetation communities. Typical plant species that dominate forested wetlands include: Fremont cottonwood, yellow willow (*Salix lasiandra*), sandbar willow (*Salix exigua*), Gooding's willow (*Salix gooddingii*), California wild rose (*Rosa californica*), and mugwort (*Artemisia douglasiana*). Older and more diverse stands of forested wetland are associated with the blowout ponds (discussed under "Permanent Pond Habitat," below) on Webb and Holland Tracts, or near residences on the islands. Younger stands of willow and cottonwood are often found in or along ditches or at the base of perimeter levees.

Forested wetland communities provide foraging, migration, dispersal, and breeding habitat for a variety of wildlife species, including many amphibians and reptiles. Within the project area, common species may include Pacific chorus frog, western toad (*Bufonidae boreas*), western pond turtle (*Emys marmorata*), mourning dove (*Zenaida macroura*), and the yellow-rumped warbler (*Dendroica coronata*).

Tidal Marsh

Tidal marsh is a wetland type located in the intertidal zone that is subject to daily fluctuations of moisture and salinity in locations that are sheltered from wave action. Tidal marsh is characterized by wetland plants and inhabited by wildlife uniquely adapted to the fluctuating conditions. Although tidal marsh is considered as one wetland type, from an ecological perspective there are several zones that make up a tidal marsh. These are differentiated based on an elevational gradient and consist of mud flats, low marsh, and high marsh. High marsh typically grades into adjacent upland areas by way of an upland ecotone (U.S. Fish and Wildlife Service 2009b).

Tidal marsh is located along the margins of in-channel islands (or "berms") in the Delta, a small area of which is included in the project area due to its proximity to the proposed discharge pump stations on Bacon Island and Webb Tract. When inundated, this wetland type supports valuable rearing habitat for fry and juvenile fish such as gobies (e.g. yellowfin goby, *Acanthogobius flavimanus*) and sculpins (*Cottus* spp.). Tidal marsh also provides foraging habitat and cover for waterfowl and wading birds including mergansers (*Mergus* sp.), canvasback (*Aythya valisineria*), and redhead (*Aythya americana*). Emergent aquatic insects are common in tidal marshes and emergent vegetation provides roosting habitat for the tricolored blackbird (*Agelaius tricolor*) during the nonbreeding season and provides nesting and foraging habitat for marsh wren (*Cistothorus palustris*).

Canals and Ditches

On the project islands, canals and ditches are used to convey water (irrigation and drainage) for agricultural operations. Generally, there are one or two major canals on each island that are aligned centrally along the north-south and/or east-west axis, with several intersecting canals that branch out from this main channel. Smaller ditches then connect to these lateral canals to convey water to or from outlying areas. While not all of the smaller canals and ditches are regularly maintained, the plant communities growing along the ditches are typical of those found in actively farmed areas, as most ditches are regularly disturbed. Common species found along the banks include Himalayan blackberry, dallisgrass (*Paspalum dilatatum*), knotgrass (*Paspalum distichum*), and smartweed (*Persicaria amphibia* var. *emersa*).

Irrigation channels located adjacent to agricultural lands provide water, cover, and foraging habitat for wildlife in adjacent habitats. Mammals include raccoon, striped skunk, and coyote. Aquatic species include mosquito fish (*Gambusia affinis*), Louisiana red swamp crayfish (*Procambarus clarkii*), and bullfrog tadpole (*Rana catesbeiana*). Common garter snake uses these areas for foraging as well. In addition, ditches with slow moving water and abundant cover may provide suitable aquatic habitat for the Federal- and state-listed giant garter snake.

Permanent Pond

Permanent pond habitat on the project islands consists primarily of three blowout ponds (formed by high-velocity floodwaters that entered the islands through levee breaks) on Webb and Holland Tracts. The ponds are bordered with a narrow strip of dense emergent vegetation with dense, mature riparian habitat encompassing the wider outer perimeter. Permanent ponds provide habitat for several aquatic plant species including water hyacinth (*Eichhornia crassipes*), water primrose (*Ludwigia sp.*), and azolla (*Azolla filiculoides*).

Open water habitats such as permanent ponds may support various types of aquatic species such as fish, waterfowl, and some reptiles and mammals. Mallard, American coot, common moorhen (*Gallinula chloropus*), snowy egret (*Egretta thula*), river otter (*Lutra canadensis*), and resident warm water fish species are all common wildlife to this habitat type on the project islands.

Tidal Channels

Delta river channels are characterized by depths of more than 20 feet and strong tidal and river currents, typically 30-40 centimeters per second (cm/sec) or 1.1-1.5 feet per second (ft/sec) or more. These channels extend to within approximately 150 feet of the shoreline. The deep water navigation channel in the lower San Joaquin River extends through the Delta upstream to the Port of Stockton. A similar deepwater ship channel extends upstream on the Sacramento River to Sacramento. The Stockton deep water channel passes north of Webb Tract. The river bottom in the navigation channels where water velocities are high is generally composed of sand. Finer silt and other sediments occur adjacent to the main channel in areas where water velocities are reduced.

Invertebrates, which inhabit the main channels, include bottom-dwelling polychaetes, amphipods, bivalves, and bay shrimp (bay shrimp include *Palaemon macrodactylus* and *Crangon* spp.). These two bay shrimp are harvested commercially as part of a local bait fishery. The open waters of the lower Sacramento and San Joaquin Rivers and Delta also serve as migratory routes for several species of anadromous fish; adults migrate to the freshwater reaches of the tributary rivers to spawn and juveniles migrate downstream to return to the ocean. These fish include steelhead (*Oncorhynchus mykiss*), Chinook salmon (*Oncorhynchus tshawytscha*), white and green sturgeon (*Acipenser transmontanus* and *A. medirostris*), and striped bass (*Morone saxatilis*). In addition, the main channel and adjacent areas support populations of resident species including Sacramento pikeminnow (Ptychocheilus grandis), white catfish (*Ameiurus catus*), and threadfin shad (*Dorosoma petenense*). Additional discussion on fish species occupying habitats in tidal channels is provided in Section 3.4, “Aquatic Resources, Including Wetlands.”

Special-Status Species

The project islands lie within the general geographic range of a number of special-status species. For purposes of this assessment, special-status species are those species that are listed as rare, threatened or endangered, candidates for listing, and species proposed for listing as threatened or endangered under the ESA or the California Endangered Species Act (CESA). This includes the following:

- Plants and animals listed or proposed for listing as threatened or endangered under ESA (50 Code of Federal Regulations [CFR] Section 17.12 [listed plants], Section17.11 [listed animals] and various notices in the Federal Register [FR; proposed species]).

- Plants and animals that are candidates for possible future listing as threatened or endangered under ESA (61 FR 40, February 28, 1996).

- Plants listed or proposed for listing by the State of California as threatened or endangered (as defined by Section 2067 of the California Fish and Game Code) or listed as rare (as defined by Section 1901 of the California Fish and Game Code) (14 California Code of Regulations [CCR] 670.2).

- Animals listed or proposed for listing by the State of California as threatened or endangered under CESA (14 California Code of Regulations [CCR] 670.5).

This biological resources section addresses special-status species that are not strictly aquatic while Section 3.4, "Aquatic Resources, Including Wetlands" addresses special-status aquatic organisms, including fish. Tables 3.5-2 and 3.5-3 present the special-status plants and wildlife, respectively, with the potential to occur in the project area, along with their Federal and state listing status and distribution and habitat requirements. The likelihood of occurrence of each special-status species is also summarized in the table. This list of species was developed using information and records from the CNDDB (California Department of Fish and Wildlife 2013), the CNPS Rare Plant Inventory (California Native Plant Society 2015), and the USFWS list of Federally endangered and threatened species that occur within USGS Rio Vista, Isleton, Thornton, Jersey Island, Bouldin Island, Terminous, Brentwood, Woodward Island, and Holt 7.5-minute topographic quadrangles (U.S. Fish and Wildlife Service 2010). There are no areas of critical habitat for special-status plants or terrestrial wildlife within the project area.

Special-Status Plants

Five special-status plants are identified as occurring within the greater project region (San Joaquin and Contra Costa Counties) and have the potential to occur within the project area based on the presence of suitable habitat. The current list of special-status plants with the potential to occur within the project area is substantially shorter than the 2001 FEIS due to a different definition of "special-status." The earlier analysis included in its definition of "special-status" plants those species that were identified as rare or endangered in the California Native Plant Society's *Inventory of Rare and Endangered Plants of California* 4th Edition (Smith and Berg 1988). The current analysis addresses only those plants listed as threatened or endangered by the Federal ESA and plants listed as threatened, endangered, or rare by CESA. In addition, this analysis includes Bogg's Lake hedge-hyssop (*Gratiola heterosepala*), which was not included in the 2001 FEIS. This species has been observed in San Joaquin County near the Amador County line in vernal pools (California Department of Fish and Wildlife 2013). These occurrences are not located close to the project area; however, suitable habitat is present in freshwater marsh on the project islands.

A number of targeted field surveys for special-status plants have been conducted within the project area. As reported in the 2001 FEIS, surveys were conducted in April and August-September 1988 and August 1994. The surveys covered all potential habitats within the project area, including water and land sides of exterior levees. Survey methods followed the DFW protocol that was current at the time of the surveys (California Department of Fish and Wildlife 1983). During these surveys, Mason's lilaeopsis (*Lilaeopsis masonii*) was observed and mapped along the exterior levee slopes of Bacon Island (18 populations), Webb Tract (3 populations), and Bouldin Island (5 populations). No other Federal- or state-listed plants were observed during the surveys. DWR conducted special-status plant surveys in 2002 that used two methods: (1) boat surveys of levee faces and in-channel islands

Table 3.5-2
List of Potentially Affected Special-Status Plant Species

Common and Scientific Name	Legal Status[a] Federal/State/ CRPR	Habitat Requirements	Blooming Period	Likelihood of Occurrence
Contra Costa wallflower *Erysimum capitatum* var. *angustatum*	E/E/1B.1	Inland dunes; 3–20 meters	Mar–Jul	**Unlikely.** Known only from Contra Costa County. Suitable habitat is not present in the project area.
Delta button-celery *Eryngium racemosum*	–/E/1B.1	Riparian scrub in vernally mesic clay depressions; 3–30 meters	Jun–Sep	**Low.** Not known to occur in the project area. Suitable habitat is not present in the project area.
Bogg's Lake hedge-hyssop *Gratiola heterosepala*	–/E/1B.2	Shallow water along the margins of lakes, marshes, swamps, and vernal pools; 10–2,375 meters	Apr–Aug	**Low.** Not known to occur in the project area. Marginal habitat is present within freshwater marshes and along the perimeter of permanent ponds.
Mason's lilaeopsis *Lilaeopsis masonii*	–/R/1B.1	Riparian scrub, brackish, or freshwater marshes and swamps; below 10 meters	Apr–Nov	**Present**. Known to occur on the shores of all project islands.
Antioch Dunes evening-primrose *Oenothera deltoides* ssp. *howellii*	E/E/1B.1	Inland dunes; below 30 meters	Mar–Sep	**Unlikely**. Known from three native occurrences in northeastern San Francisco Bay. Suitable habitat is not present in the project area.

Notes:
[a] Status explanations:
Federal
E = listed as endangered under the Federal Endangered Species Act.
– = no listing.
State
E = listed as endangered under the California Endangered Species Act.
R = listed as rare under the California Native Plant Protection Act (this category is no longer used for newly listed plants, but some plants previously listed as rare retain this designation).
– = no listing.
California Rare Plant Rank (CRPR):
1B = Plant species considered rare or endangered in California and elsewhere (but not legally protected under the Federal or California Endangered Species Acts).
California Rare Plant Rank Extensions:
.1 = seriously endangered in California (>80 percent of occurrences are threatened and/or have a high degree and immediacy of threat).
.2 = fairly endangered in California (20-80 percent of occurrences are threatened and/or have a moderate degree and immediacy of threat).
Sources: California Native Plant Society 2015; California Department of Fish and Wildlife 2013; U.S. Fish and Wildlife Service 2010

Table 3.5-3
List of Potentially Affected Wildlife Species

Species	Status Federal/State	Suitable Habitat	Likelihood of Occurrence
Invertebrates			
Branchinecta conservatio Conservancy fairy shrimp	FE/--	Occurs in large, turbid vernal pools in the northern two-thirds of the Central Valley. Pools are typically astatic and are formed in old, braided alluvium.	**Unlikely.** No suitable habitat on the project islands.
Branchinecta longiantenna Longhorn fairy shrimp	FE/--	Occurs in small, clear pools in sandstone rock outcrops of clear to moderately turbid clay- or grass-bottomed pools.	**Unlikely.** No suitable habitat on the project islands.
Branchinecta lynchi Vernal pool fairy shrimp	FT/--	Occurs in vernal pools, seasonally ponded areas within vernal swales, rock outcrop ephemeral pools, playas and alkali flats from Shasta County through most of the length of the Central Valley to Tulare County. Pools are grass or mud-bottomed with clear to tea-colored water, and are often in basalt flow depression pools in grasslands.	**Unlikely.** No suitable habitat on the project islands.
Desmocerus californicus dimorphus Valley elderberry longhorn beetle	FT[1]/--	Breeds and forages exclusively on elderberry shrubs (*Sambucus mexicana*) typically associated with riparian forests, riparian woodlands, elderberry savannas, and other Central Valley habitats. Occurs only in the Central Valley of California. Prefers to lay eggs in elderberries 2–8 inches in diameter; some preference shown for "stressed" elderberries.	**Low.** Suitable habitat is present on one of the project islands. One large cluster of elderberry shrubs on Holland Tract; no VELB observed during field surveys performed in 2002 and 2003.
Elaphrus viridus Delta green ground beetle	FT/--	Restricted to Olcott Lake and other vernal pools at Jepson Prairie Preserve, Solano County.	**Unlikely.** No suitable habitat on the project islands.
Lepidurus packardi Vernal pool tadpole shrimp	FE/--	Occurs in vernal pools containing clear to highly turbid water.	**Unlikely.** No suitable habitat on the project islands.
Amphibians			
Ambystoma californiense California tiger salamander, central population	FT/SSC	Annual grassland and grassy understory of valley-foothill hardwood habitats in central and northern California. Needs underground refuges and vernal pools or other seasonal water sources.	**Unlikely.** Species not known to occur in the Delta currently or historically (Jennings and Hayes 1994; California Department of Fish and Wildlife 2013).

Table 3.5-3
List of Potentially Affected Wildlife Species

Species	Status Federal/State	Suitable Habitat	Likelihood of Occurrence
Rana draytonii California red-legged frog	FT/SSC	Breeds in slow moving streams, ponds, and marshes with emergent vegetation and an absence or low occurrence of predators.	**Unlikely.** Species not known to occur in the Delta currently or historically (Jennings and Hayes 1994; California Department of Fish and Wildlife 2013).
Reptiles			
Masticophis lateralis euryxanthus Alameda whipsnake	FT/ST	Found in valleys, foothills, and low mountains in Alameda and Contra Costa Counties. Typically associated with northern coastal scrub or chaparral habitat; requires rock outcrops for cover and foraging.	**Unlikely.** No suitable habitat on the project islands.
Thamnophis gigas Giant garter snake	FT/ST	Found primarily in marshes, sloughs, drainage canals, and irrigation ditches, especially around rice fields, and occasionally in slow-moving creeks in California's interior.	**Medium.** All project islands provide suitable aquatic and upland habitat for this species. There is one known occurrence at Webb Tract and one occurrence northeast of Bacon Island (California Department of Fish and Wildlife 2013), however this species was not encountered during focused surveys conducted in 2002-2003 (California Department of Water Resources 2003).
Birds			
Aquila chrysaetos Golden eagle	BEPA/FP	Nests on cliffs and escarpments or in tall trees overlooking open country. Forages in annual grasslands, chaparral, and oak woodlands with plentiful medium- and large-sized mammals.	**Unlikely.** Project islands provide suitable foraging habitat but no suitable nesting habitat, therefore species could occasionally occur.
Buteo swainsoni Swainson's hawk	--/ST	Forages in open and agricultural fields and nests in mature trees usually in riparian corridors.	**Medium.** Suitable nesting and foraging habitat present. Documented nesting sites on Webb Tract and Bacon Island during 2002 surveys (California Department of Water Resources 2003). Also known to nest on adjacent islands (California Department of Fish and Wildlife 2013).
Falco peregrines anatum American peregrine falcon	--/SE, FP	Nests and roosts on protected ledges of high cliffs, usually adjacent to lakes, rivers, or marshes that support large prey populations.	**Unlikely.** Project islands provide suitable foraging habitat but no suitable nesting habitat. Observed foraging on all project islands during 2002-2003 DWR surveys (California Department of Water Resources 2003).

Table 3.5-3
List of Potentially Affected Wildlife Species

Species	Status Federal/State	Suitable Habitat	Likelihood of Occurrence
Grus canadensis tabida Greater sandhill crane	--/ST, FP	Summers in open terrain near shallow lakes or freshwater marshes. Winters in plains and valleys near bodies of fresh water.	**High.** Project islands provide wintering habitat; observed on all islands during 2002-2003 surveys (California Department of Water Resources 2003) and during site visits in 2011-2012 (Environmental Science Associates 2012).
Haliaeetus leucocephalus Bald eagle	BEPA/SE	In western North America, nests and roosts in coniferous forests within approximately 1 mile of a lake, reservoir, stream, or the ocean.	**Low.** Project islands provide suitable foraging habitat but no suitable nesting habitat, therefore species could occasionally occur.
Laterallus jamaicensis coturniculus California black rail	--/ST, FP	Found in tidal salt marshes associated with heavy growth of pickleweed; also occurs in brackish marshes or freshwater marshes at low elevations.	**Low.** Lower-quality habitat present on Webb Tract and Holland Tract. Surveys conducted around Bacon Island in 2002 resulted in negative findings (California Department of Water Resources 2003). Known to nest near all islands (in channel berms) except Webb Tract (California Department of Fish and Wildlife 2013).
Rallus longirostris obsoletus California clapper rail	FE/SE, FP	Restricted to salt marshes and tidal sloughs; usually associated with heavy growth of pickleweed; feeds on mollusks removed from the mud in sloughs	**Unlikely.** No suitable habitat is present, and project islands are outside of species' known range.
Riparia riparia Bank swallow	--/ST	Nests in bluffs or banks, usually adjacent to water, in excavated dirt tunnels near the top of steep banks where the soil consists of sand or sandy loam.	**Low.** No suitable habitat is present on the project islands but foraging habitat is available.
Mammals			
Sylvilagus bachmani riparius Riparian brush rabbit	FE/SE	Historically associated with dense riparian forests along portions of the San Joaquin River and its tributaries on the Valley Floor. Currently the only known extant population occurs in Caswell Memorial State Park along the Stanislaus River in the largest remaining fragment of suitable riparian forest in the region.	**Unlikely.** The project islands are outside of the species' current known range.
Vulpes macrotis mutica San Joaquin kit fox	FE/ST	Primarily occurs in the San Joaquin Valley and adjacent open foothills to the west. Associated with saltbush scrub, grassland, oak, savanna, and freshwater scrub habitats.	**Unlikely.** Unlikely to occur on the project islands due to limited access (i.e. being surrounded by waterways).

Table 3.5-3
List of Potentially Affected Wildlife Species

Species	Status Federal/State	Suitable Habitat	Likelihood of Occurrence

Notes:

[1] Valley elderberry longhorn beetle is currently proposed for delisting.

Status Codes:

Federal	State
FE = Endangered	SE = Endangered
FT = Threatened	ST = Threatened
FC = Candidate	FP = Fully Protected
BEPA = Bald Eagle Protection Act	SSC = (California Department of Fish and Wildlife Special Concern species

Sources: California Department of Fish and Wildlife 2013; U.S. Fish and Wildlife Service 2010 adjacent to the project islands, and (2) foot and vehicle surveys of the interior of the project islands (California Department of Water Resources 2003). Mason's lilaeopsis was observed at 120 locations on the project islands and on adjacent in-channel islands. The majority of these observations (108) were on in-channel islands; Mason's lilaeopsis was not observed on Holland Tract. No other special-status plants (as defined in this analysis) were observed during the surveys.

State-Listed Plant Species

Mason's Lilaeopsis

Mason's lilaeopsis occurs on tidally influenced mudflats and mud-banks of sloughs and rivers, freshwater and brackish marsh, and riparian scrub. Populations are distributed through the Delta and sloughs, Suisun Marsh, and Lower Napa River. The species typically grows in saturated clay substrates that are inundated by tidal action or waves on a regular basis. Common associates of this species include bulrush (*Schoenoplectus* spp.), bugleweed (*Lycopus* spp.), marsh pennywort (*Hydrocotyle* spp.), rushes (*Juncus* spp.), spikerush (*Eleocharis* spp.), loosestrife (*Lythrum* spp.), dock (*Rumex* spp.), coyote thistle (*Eryngium* spp.), willow (*Salix* spp.), cattail (*Typha* spp.), and horsetail (*Equisetum* spp.) (California Department of Fish and Wildlife 2013).

Special-Status Wildlife

Twenty special-status wildlife species are identified as occurring within the project vicinity and have the potential to occur on the project islands based on the presence of suitable habitat (Table 3.5-3). The 2001 FEIS included 10 species, nine of which were bird species. Subsequent analyses for the project, including 2002-2003 DWR reports and the 2010 DEIR, expanded the initial list to include various types of special-status invertebrates, amphibians, reptiles, birds, and mammal species. However, while this SEIS considers additional species that may occur in the region, no new species were identified as having the potential to be affected by the project.

Several field surveys for wildlife species have been conducted on the project islands. As described in the 2001 FEIS, general and focused wildlife assessment surveys were conducted in 1988-1989. Species that were targeted in the surveys consisted of valley elderberry longhorn beetle (VELB), giant garter snake, California black rail, greater sandhill crane, Swainson's hawk, northern harrier, bald eagle, and peregrine falcon. Subsequent surveys for VELB, giant garter snake, greater sandhill crane, Swainson's hawk (nesting), California black rail (passive surveys), and general bird surveys were conducted by DWR in 2002-2003 in support of the In-Delta Storage Program Feasibility Study. The results of these surveys (as they pertain to the special-status species evaluated in this document) are summarized in Table 3.5-3.

Federally Listed Wildlife Species

Based on a review of wildlife species (excluding fish) in the Rio Vista, Isleton, Thornton, Jersey Island, Bouldin Island, Terminous, Brentwood, Woodward Island, and Holt, 7.5-minute quadrangles (U.S. Fish and Wildlife Service 2010), a total of 13 Federally listed and protected species have the potential to occur within the project area. Of these, four are known to occur on the project islands (VELB, giant garter snake, Swainson's hawk, and greater sandhill crane). An updated description for each of these species is provided below.

Valley Elderberry Longhorn Beetle

VELB, a species that is Federally listed as threatened (but currently proposed for delisting), is a small insect that spends most of its life within the stems of an elderberry (*Sambucus spp.*) shrub. Females lay their eggs within the bark, where larvae hatch and bore into the stems. Larvae remain within the stems for 1-2 years. In March, when the elderberries begin to flower, the larvae pupate and emerge as adults. Mating usually occurs in June. Often, the only indicators of VELB presence are the distinctive small oval openings that are left after larvae pupate and emerge (UC Berkeley 2005; U.S. Fish and Wildlife Service 2009a).

VELB use elderberry shrubs with a stem diameter of at least 1 inch (at ground level) as a host plant (U.S. Fish and Wildlife Service 2009a). In the Central Valley, elderberry shrubs are fairly common in remaining riparian forests and adjacent uplands (UC Berkeley 2005). Elderberry shrubs are typically found growing in association with other riparian species, but they can also occur as isolated shrubs in upland areas. Historically, VELB ranged throughout the Central Valley. Currently, they are common in scattered populations from Redding to Bakersfield where historical riparian forests still exist (U.S. Fish and Wildlife Service 2009a).

During initial field surveys performed in 1997-1998, one small cluster of elderberry shrubs was identified on Holland Tract. These shrubs did not exhibit evidence of VELB presence. Subsequent field surveys completed in 2002 and 2003 found no additional shrubs. Based on these surveys, Holland Tract is the only island known to support elderberry shrubs suitable for occupation by VELB.

Giant Garter Snake

The giant garter snake, a species Federally listed as threatened, is a large, mostly aquatic snake that inhabits agricultural wetlands and other waterways such as irrigation and drainage canals, rice fields, managed marsh areas, sloughs, ponds, small lakes, low-gradient streams, and adjacent uplands in the Central Valley. During the active season, giant garter snakes require adequate water to provide food and cover, and emergent, herbaceous wetland vegetation such as cattails and bulrushes for escape cover and foraging habitat. Giant garter snake requires grassy banks and openings in waterside vegetation for basking, and higher elevation uplands for cover and refuge from flood waters during the snake's dormant season. This species is typically absent from larger rivers because of lack of suitable habitat and emergent vegetative cover, and is also generally absent from wetlands with sand, gravel, or rock substrates, and from riparian woodlands.

The giant garter snake is active in the early spring through mid-fall (mid March through October), breeds from March through April, bears live young from July to September, and is dormant in the winter (Zeiner et al. 1988–1990). The giant garter snake feeds primarily on small fish and amphibians. Historically, the range of this snake was the San Joaquin Valley from the vicinity of Sacramento and Antioch southward to Buena Vista and the Tulare Lake Basin. The current distribution extends from near Chico in Butte County to the vicinity of Burrel in Fresno County (California Department of Fish and Wildlife 2000). This species was listed as threatened by the state of California in 1971 and as threatened by the Federal government in 1993.

As described previously, a single giant garter snake was identified on the southwestern levee of Webb Tract in 2002 (California Department of Fish and Wildlife 2013). Surveys conducted in 2003 and 2004 on Bacon Island and Webb Tract did not detect giant garter snakes, leading surveyors to conclude that the 2002 individual was likely washed down by high-water events from a population upstream (Hansen and Patterson 2003; Patterson 2004). DWR conducted additional trapping surveys of various sites within the Delta that met habitat assessment criteria for the giant garter snake during summer 2009 (U.S. Fish and Wildlife Service 2012). No giant garter snakes were trapped or observed during those surveys. The nearest known detection of giant garter snakes in the Delta Basin within the past 5 years was on Empire Tract near Little Connection Slough (Environmental Science Associates 2010).

Potential giant garter snake habitat on the project islands, as determined through habitat assessment and focused surveys performed by DWR during 2003 and 2004 (two full seasons), is found primarily within the contiguous irrigation canals and ditches, but is also present along the perimeter of the blow-out ponds located on a few of the islands, where dense emergent vegetation grows adjacent to the open water habitat (Hansen and Patterson 2003). Upland habitat on the project islands is present along the outer levees where stands of bulrush (*Schoenoplectus sp*.) and low growing grasses and rip-rap occur. These features, according to Hansen and Brode (as cited in Hansen and Patterson 2003), provide some suitable habitat for basking, breeding, and hibernation sites. Within the agricultural drainage system on the project islands, the larger canals (generally along the central north-south or east-west axis) are generally kept free of vegetation. However, many of the smaller lateral ditches are not regularly maintained and could provide escape cover and foraging habitat for this species.

State-Listed Wildlife Species

Based upon the CNDDB database search for special-status species as well as an analysis of habitat suitability on the project islands, a total of 12 state-listed species were identified that have the potential to occur within and/or adjacent to the project islands. Of these, two are known to occur on the project islands: Swainson's hawk and greater sandhill crane. These species are described in more detail below. The remaining 10 state-listed species are identified in Table 3.5-3.

Swainson's Hawk

The Swainson's hawk is a long-distance migrant raptor species. The Central Valley population winters primarily in Mexico and arrives on its breeding grounds in the Central Valley in mid-March to early April. Nests are generally found in scattered trees or along riparian systems adjacent to agricultural fields or pastures, but the species will also nest in tall shrubs and trees in proximity to developments near foraging habitat. Prey species mainly consist of small mammals, reptiles, and insects. Egg-laying generally occurs in April and young hatch in May and June. Most young have fledged the nest by the end of July and are relatively independent of parental protection. However, fledged young remain with their parents until they migrate in the fall. Migration to the wintering grounds generally occurs around September. Some individuals or small groups may winter in California (Zeiner et al. 1988–1990).

The project is located in an area that supports a large number of nesting locations and ample upland habitat for foraging. The CNDDB has 21 recorded occurrences of Swainson's hawk within 5 miles of the project islands. Of these occurrences, one occurrence was classified as extirpated, leaving 20 presumed extant locality records (California Department of Fish and Wildlife 2011). Three of the 21 records were recent sightings (reported within the last 5 years) and 17 sightings were made over 5 years ago.

Greater Sandhill Crane

Greater sandhill crane breeds in open, isolated wetlands surrounded by shrubs or forested habitat. Diverse structural vegetation, including bulrush and cattails, are used for nesting sites (Tacha et al. 1992). Habitats such as meadows, irrigated pastures and fields, bogs, fens, and marshes are used as foraging areas. Wintering populations roost in shallow open water, marshes, rivers, and lakes, where they flock together at night for safety (Eckert and Karalus 1981). Wintering populations feed primarily in irrigated croplands and pastures. Moist sites are commonly used, but this species also feeds on dry plains far from water. Food items consist of crops such as wheat, sorghum, barley, oats, corn, and rice as well as insects, snails, reptiles, small mammals, seeds, and berries (Tacha et al. 1992).

Greater sandhill crane is known to winter throughout the Delta region. They have been observed foraging in agricultural fields on all four project islands (California Department of Water Resources 2003, Environmental Science Associates 2012).

Critical Habitat

There is no established critical habitat for terrestrial wildlife species within the project area.

Invasive Plants

Many species of invasive plants are considered undesirable at the regional and local levels in the context of the project due to their potential to degrade wildlife habitats and affect wetland quality and services. Active management of invasive plants is based on an adaptive approach has therefore been included as an Environmental Commitment of the project. Project-related management of targeted invasive plant populations would also help to prevent further spread in the Delta region.

Table 3.5-4 presents a list of invasive plants that are considered to be a management priority at the Delta regional level. This table identifies the invasive plants that are known to be present on the project islands and those that are considered important management priorities within the Delta region. The table includes plants on the California Department of Food and Agriculture's (CDFA) noxious weed list and those listed by the California Invasive Plant Council (Cal-IPC) as being a threat to wildlands, as defined by Warner et al. (2003). CDFA is responsible for designating plants as "noxious weeds" (per CCR, Food and Agriculture Code Section 5004) and maintains a list of designated noxious weeds both for agriculture and wildlands. Cal-IPC is an organization dedicated to protecting California from invasive plants though research, education, and policy and maintains an online inventory of invasive plants that have negative ecological impacts. Additionally, seven invasive plant species were identified by DWR as "weed species of concern" for the project (California Department of Water Resources 2003). These seven species consist of:

- Giant reed (*Arundo donax*)
- Water hyacinth (*Eichhornia crassipes*)
- Perennial pepperweed (*Lepidium latifolium*)
- Cape ivy (*Delairea odorata*)
- Pampas grass (*Cortaderia jubata*)
- Purple loosestrife (*Lythrum salicaria*)
- Himalayan blackberry (*Rubus armeniacus*)

The Draft CMP (attached as Appendix B) addresses an approach for early detection and management of the weed species of concern and for the broader group of regionally important invasive plants.

3.5.3 REGULATORY FRAMEWORK/APPLICABLE LAWS, REGULATIONS, PLANS, AND POLICIES

This assessment only includes plant and wildlife species that are listed or proposed as threatened or endangered at the Federal level, and species that are listed by the State of California as threatened or endangered. Species with other local considerations or listings were excluded from this analysis at the direction of USACE.

FEDERAL

Federal Endangered Species Act

The ESA grants protection over species that are formally listed as threatened endangered, or proposed for listing. The primary protective requirement in the case of projects requiring Federal permits, authorizations, or funding is Section 7 of ESA, which requires Federal lead agencies to consult (or "confer" in the case of proposed species or proposed critical habitat) with the USFWS (and National Marine Fisheries Service [NMFS] where marine species may be affected) to ensure that their actions do not jeopardize the continued existence of Federally listed species. In addition to Section 7 requirements, Section 9 of the ESA protects listed wildlife species from "take." Take is broadly defined as those activities that "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect [a protected species], or attempt to engage in any such conduct." USFWS regulations at 50 CFR Section 17.3 provide further definitions of harass and harm. Harass is defined as "an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering" (50 CFR Section17.3). Harm is defined as "an act which actually kills or injures wildlife. Such act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering" (50 CFR Section17.3).

Table 3.5-4
Invasive Plant Species Identified as Occurring on the Project Islands or Listed by Weed Management Areas in the Project Vicinity

Common Name	Scientific Name	Known on Project Islands[a]	Listed by Weed Management Areas in Project Vicinity[b]	Cal-IPC Status[c]	CDFA Status[d]
Kangaroo thorn	*Acacia paradoxa*		✓		B
Puna grass	*Stipa brachychaeta*		✓		A
Russian knapweed	*Acroptilon repens*	✓	✓	Moderate	B
Barbed goatgrass	*Aegilops triuncialis*		✓	High	B
Tree of heaven	*Ailanthus altissima*	✓		Moderate	C
Giant reed	*Arundo donax*	✓	✓	High	B
Black mustard	*Brassica nigra*	✓		Moderate	
Red brome	*Bromus madritensis ssp. rubens*	✓		High	
Thoroughwax	*Bupleurum lancifolium*		✓		
Plumeless thistle	*Carduus acanthoides*		✓	Limited	A
Italian thistle	*Carduus pycnocephalus*	✓	✓	Moderate	C
Smooth distaff thistle	*Carthamus creticus*		✓		B
Purple star-thistle	*Centaurea calcitrapa*		✓	Moderate	B
Iberian star-thistle	*Centaurea iberica*		✓		A
Yellow star-thistle	*Centaurea solstitialis*	✓	✓	High	C
Canada thistle	*Cirsium arvense*		✓	Moderate	B
Bull thistle	*Cirsium vulgare*	✓	✓	Moderate	C
Poison hemlock	*Conium maculatum*	✓		Moderate	
Jubata grass	*Cortaderia jubata*		✓	High	B
Pampas grass	*Cortaderia selloana*	✓		High	
Japanese dodder	*Cuscuta japonica*		✓		A
Artichoke thistle	*Cynara cardunculus*		✓	Moderate	B
Nutsedge	*Cyperus spp.*		✓		
Cape ivy	*Delairea odorata*			High	
Brazilian egeria	*Egeria densa*	✓	✓	High	C
Veldt grass	*Ehrharta calycina*			Moderate	
Water hyacinth	*Eichhornia crassipes*	✓	✓	High	C
Medusahead	*Elymus caput-medusae*	✓	✓	High	C
Blue gum	*Eucalyptus globulus*	✓		Moderate	
Oblong spurge	*Euphorbia oblongata*		✓	Limited	B
Edible fig	*Ficus carica*	✓		Moderate	
Fennel	*Foeniculum vulgare*	✓		High	
Wavy-leaved gaura	*Gaura sinuata*		✓		B
Monterey cypress	*Hesperocyparis macrocarpa*		✓		
Velvet grass	*Holcus lanatus*	✓		Moderate	
Hydrilla	*Hydrilla verticillata*			High	A
Yellow water iris	*Iris pseudacorus*	✓		Limited	Q
Globe-podded hoary cress	*Lepidium appelianum*		✓	Limited	B
Hoary cress	*Lepidium draba*		✓	Moderate	B
Perennial pepperweed	*Lepidium latifolium*	✓	✓	High	B

Table 3.5-4
Invasive Plant Species Identified as Occurring on the Project Islands or Listed by Weed Management Areas in the Project Vicinity

Common Name	Scientific Name	Known on Project Islands[a]	Listed by Weed Management Areas in Project Vicinity[b]	Cal-IPC Status[c]	CDFA Status[d]
Dalmatian toadflax	*Linaria dalmatica ssp. dalmatica*		✓	Moderate	A
Purple loosestrife	*Lythrum salicaria*	✓	✓	High	B
Parrot's feather	*Myriophyllum aquaticum*	✓		High	
Eurasian watermilfoil	*Myriophyllum spicatum*	✓		High	C
Crispate-leaved pondweed	*Potamogeton crispus*	✓		Moderate	
Himalayan blackberry	*Rubus armeniacus*	✓	✓	High	
Russian thistle	*Salsola spp.*		✓		
Golden thistle	*Scolymus hispanicus*		✓		A
Red sesbania	*Sesbania punicea*		✓	High	Q
Milk thistle	*Silybum marianum*		✓	Limited	
Silverleaf nightshade	*Solanum elaeagnifolium*	✓	✓	Evaluated but not listed	B
Johnson grass	*Sorghum halepense*	✓	✓		C
Tamarisk	*Tamarisk spp.*	✓	✓		
Puncture vine	*Tribulus terrestris*		✓		C
Spiny cocklebur	*Xanthium spinosum*		✓		

Notes: CDFA = California Department of Food and Agriculture; Cal-IPC = California Invasive Plant Council

[a] As reported in California Department of Water Resources 2003.

[b] Weed Management Areas (WMAs) in the project area consist of the Alameda-Contra Costa WMA and the Central Valley WMA.

[c] According to California Invasive Plant Council 2006. Cal-IPC status explanations:

- High: Species that have severe ecological effects on physical processes, plant and animal communities, and vegetation structure. These species have moderate to high rates of dispersal and establishment based on their reproductive biology and other characteristics and have a wide ecological distribution.
- Moderate: Species that have substantial and apparent—but generally not severe—ecological effects on physical processes, plant and animal communities, and vegetation structure. These species have moderate to high rates of dispersal based on their reproductive biology and other characteristics; however, establishment is generally dependent upon ecological disturbance. The ecological amplitude and distribution of these species varies from widespread to limited.
- Limited: Species that are invasive but have ecological effects are relatively minor on a statewide level or adequate data was not available to justify a higher score. These species have low to moderate rates of invasiveness based on their reproductive biology and other characteristics. Although these species may be locally persistent and problematic, their ecological amplitude and distribution are generally limited.

[d] According to California Department of Food and Agriculture 2008. CDFA status explanations:

A = Eradication, containment, rejection, or other holding action at the state/county level. Quarantine interceptions to be rejected or treated at any point in the state.

B = Eradication, containment, control or other holding action at the discretion of the Agricultural Commissioner.

C = State endorsed holding action and eradication only when found in a nursery; action to retard spread outside of nurseries at the discretion of the Agricultual Commissioner; reject only when found in a cropseed for planting or at the discretion of the Agricultural Commissioner.

Q = Temporary "A" action outside of nurseries at the state/county level pending determination of a permanent rating.

Source: ICF 2010:4.6-27

An activity can be in violation of take prohibitions even if the activity is unintentional or accidental. Substantial modification or degradation of occupied habitat for listed species, or activities that prevent or substantially impair essential behavioral patterns, including breeding, feeding, or sheltering, are also considered “take” under the ESA. Federal agencies may receive authorization for the incidental take of listed species under Section 7 through the issuance of a Biological Opinion from the USFWS and/or NMFS. State, local, and private entities may receive incidental take authorization under an approved Habitat Conservation Plan (HCP). USACE is the lead Federal agency responsible for consultation with the USFWS under Section 7 of ESA for this project.

Migratory Bird Treaty Act

The Migratory Bird Treaty Act (MBTA) of 1918 makes it unlawful to take or attempt to take any migratory bird, or any part, nest, or egg of any such bird except under the terms of a permit issued by the U. S. Department of the Interior. In total, 836 bird species are protected by the MBTA, 58 of which are currently legally hunted as game birds. A migratory bird is any species or family of birds that live, reproduce, or migrate within or across international borders at some point during their annual life cycle.

The Bald Eagle Protection Act

The Bald Eagle Protection Act (16 U.S.C. 668-668c) prohibits anyone, without a permit issued by the Secretary of the Interior, from “taking” bald and golden eagles, including their parts, nests, or eggs. The act defines “take” as “pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb.” In addition to immediate effects, this definition also covers effects that result from human-induced alterations initiated around a previously used nest site during a time when eagles are not present, if, upon the eagle's return, such alterations agitate or bother an eagle to a degree that interferes with or interrupts normal breeding, feeding, or sheltering habits, and causes injury, death, or nest abandonment.

Executive Order 13112: Prevention and Control of Invasive Species

Enacted in February 1999, EO 13112 calls for Federal agencies to prevent and control the introduction of invasive species in a cost-effective and environmentally sound manner. This includes consideration of the potential effects of invasive species in NEPA analyses. The EO established an Invasive Species Council comprised of Federal agencies and headed by the Secretary of the Interior with the responsibility to oversee the executive order and prepare a national Invasive Species Management Plan that provides guidelines for preventing the introduction and spread of invasive species.

STATE

California Endangered Species Act

Pursuant to CESA and Section 2081 of the California Fish and Game Code, a permit from DFW is required for a project that could result in the take of a state-listed threatened or endangered species (i.e., species listed under CESA). Under CESA, the definition of “take” includes an activity that would directly or indirectly kill an individual of a species, but the state definition does not include “harm” or “harass,” as the Federal definition does. As a result, the threshold for take under the CESA is typically higher than that under the ESA. Under CESA, DFW maintains a list of threatened species and endangered species (California Fish and Game Code 2070).

3.5.4 ANALYSIS METHODOLOGY

The analysis methodology in this SEIS does not differ substantially from that used in the 2001 FEIS. The effects to wildlife habitats have been estimated based on existing habitat conditions and baseline information from recent surveys and data sources, compared with the location of project components and operations that would affect the extent or characteristics of suitable habitat for special-status species.

The estimate of future (post-project) habitat conditions for Alternatives 1 and 2 (Proposed Action) has been reevaluated and updated in this analysis through incorporation of the Draft CMP (Appendix B). This plan describes the methodology for the design of created and enhanced wetlands and wildlife habitats on the Habitat Islands and presents the total expected post-project acreage of each habitat type. Additionally, suitable habitat acreages both pre- and post-project for giant garter snake and Swainson's hawk are quantified in the plan based on both survey results and assessments of suitable habitat. This process is similar to the habitat evaluation procedure (HEP) methodology used in previous analyses but is based on updated information from more precise wetland and habitat mapping and recent survey data. The Draft CMP effectively updates the earlier plans outlined in the Draft CMP and provides guidance for the preservation and creation of special-status wildlife species habitat. As such, the acreages of affected and projected post-project habitat are different in the current analysis than those presented in the 2001 FEIS.

Alternative 3 would provide some on-site wildlife habitat in the North Bouldin Habitat Area (NBHA). No detailed design has been completed for this area and compensation for project effects to special-status wildlife habitat under Alternative 3 would require additional off-site habitat creation or preservation. Effects to special-status species habitat under Alternative 3 have been estimated based on the same methods as Alternatives 1 and 2; however, post-project acreage of compensation habitat is not quantified under this alternative because an off-site location for mitigation has not been identified and selected.

SIGNIFICANCE CRITERIA

The basis for determining the significance of effects for this analysis is based on professional standards, project-specific criteria developed by the lead agency to address potential effects unique to the project's location and elements, and is informed by the criteria contained in the Environmental Checklist in Appendix G of the State CEQA Guidelines. These thresholds encompass the factors taken into account under NEPA to determine the significance of an action in terms of its context and the intensity of its effects. The Proposed Action or alternatives under consideration would have a significant, adverse effect related to biological resources if they would do any of the following:

- reduce the abundance of special-status species, including species under the protection of the Migratory Bird Treaty Act, that occur within the project area;
- result in the loss or alteration of existing or proposed critical habitat for one or more listed species;
- cause a temporary loss or alteration of habitat important for one or more listed species that could result in avoidance by a listed species, or that could cause increased mortality or lowered reproductive success of the species; or
- result in direct or indirect effects on candidate or proposed species, or their habitat, that would contribute to or result in the Federal or state listing of the species (e.g., substantially reducing species numbers or resulting in the permanent loss of habitat essential for the continued existence of a species).

3.5.5 ENVIRONMENTAL CONSEQUENCES AND MITIGATION MEASURES

EFFECTS ANALYSIS

No-Action Alternative

Implementation of the No-Action Alternative would have an effect on existing habitat types, primarily as the result of the continuing conversion of fallow, riparian, and wetland habitats to agricultural use and the effects of continued subsidence on all of the islands. Increases in agricultural land use would generally result in the loss of existing wetland habitat types. As stated in the 2001 FEIS, the changes in vegetation types under the No-Action Alternative could result in a 50 percent decrease in riparian woodland and riparian scrub as well as a decrease in freshwater marsh of more than 80 percent. Therefore, implementation of the No-Action Alternative could potentially result in the loss of habitat for special-status wildlife and continued releases of organic carbon. In addition future levee maintenance required as the result of increased rates of subsidence could potentially eliminate special-status plant populations.

EFFECT BIO-1 — Introduction and Spread of Invasive Plants. *Under the No-Action Alternative, existing agricultural activities would continue and habitats would not be restored or managed with the intent of controlling invasive plant species. However, the extent of introduction and spread would be limited due to crop management activities. This effect is less than significant.*

Under the No-Action Alternative, existing agricultural activities would continue and habitats would not be restored or managed with the intent of controlling invasive plant species. Invasive plants are known to disrupt natural ecosystems, obstruct navigation, and reduce the suitability of habitats for special-status species. Without specific management actions targeting invasive species control, the introduction and spread of invasive plants throughout the project islands would continue. However, the extent of introduction and spread would be limited due to crop management activities. Therefore, this effect is **less than significant**.

EFFECT BIO-2 — Loss of Special-Status Plants. *Under the No-Action Alternative, there would be no project-related construction or operational effects to existing populations of special-status plants. Adverse effects to special-status plants would continue to be present in the form of levee and agricultural-related maintenance activities; however, these are ongoing activities and the existing plant populations have existed under this condition over time. Therefore, this effect is less than significant.*

Under the No-Action Alternative, there would be no project-related construction or operational effects to existing populations of special-status plants. Populations of Mason's lilaeopsis were observed along the exterior levee slopes of Bacon Island and Webb Tract during special-status plant surveys in 1988, 1994, and 2004. Effects to special-status plants would continue to be present in the form of levee and agricultural maintenance activities; however, these are ongoing activities and existing plant populations have existed under this condition over time. Therefore, this effect is **less than significant**.

EFFECT BIO-3 — Potential Mortality of, and Potential Loss of Suitable Habitat for, Valley Elderberry Longhorn Beetle. *Under the No-Action Alternative, there would be no project-related construction or operational effects to VELB. Adverse effects to VELB would continue to be present in the form of levee and agricultural maintenance activities; however, these are ongoing activities and VELB has existed under this condition over time, and suitable habitat is only present in a small portion of the project area. Therefore, this effect is less than significant.*

Under the No-Action Alternative, there would be no project-related construction or operational effects to VELB. Adverse effects to VELB would continue to be present in the form of levee and agricultural maintenance activities; however, these are ongoing activities and VELB has existed under this condition over time and suitable habitat for VELB is only present in the form of one small cluster of elderberry shrubs on Holland Tract. This cluster has persisted over time, and no evidence of VELB has been observed. Therefore, the take of VELB resulting from ongoing agricultural activity is unlikely and the effect is **less than significant**.

EFFECT BIO-4 — Potential Injury or Mortality of Giant Garter Snake. *Under the No-Action Alternative, there would be no project-related construction or operational effects to giant garter snake. Adverse effects to giant garter snake would continue to be present in the form of levee, ditch, canal, and other agricultural maintenance activities, and giant garter snake populations have declined substantially. Therefore, this effect is significant.*

Under the No-Action Alternative, there would be no project-related construction or operational effects to giant garter snake. Adverse effects to giant garter snake would continue to be present in the form of levee, ditch, canal, and other agricultural maintenance activities; however, these are ongoing activities and giant garter snake has existed under this condition over time. Nevertheless, although there is low potential for injury or mortality of a giant garter snake during normal agricultural activities, the loss of an individual snake would be considered a significant effect because giant garter snake has declined substantially throughout its range due to habitat loss and fragmentation from urban development and mortality as a result of water conveyance channel maintenance, leading to its current state- and Federally threatened status (U.S. Fish and Wildlife Service 1999). Therefore, this effect is **significant**.

EFFECT BIO-5 Loss of Suitable Aquatic and Upland Habitat for Giant Garter Snake. *Under the No-Action Alternative, there would be no project-related construction, conversion, modification, or loss of aquatic or upland habitat for giant garter snake. Agricultural land uses are known to provide suitable aquatic and upland habitat for giant garter snake; therefore, this effect is less than significant.*

Under the No-Action Alternative, there would be no project-related construction, conversion, modification, or loss of aquatic or upland habitat for giant garter snake. Agricultural land uses are known to provide suitable aquatic and upland habitat for giant garter snake; therefore, this effect is **less than significant**.

EFFECT BIO-6 Potential Injury or Mortality of Swainson's Hawk. *Under the No-Action Alternative, there would be no project-related construction or operational effects to Swainson's hawk or suitable habitat. Adverse effects to Swainson's hawk would continue to be present in the form of levee and other agricultural maintenance activities, which could result in the removal of trees with active nests. Therefore, this effect is significant.*

Under the No-Action Alternative, there would be no project-related construction or operational effects to Swainson's hawk or suitable nesting habitat. Adverse effects to Swainson's hawk would continue to be present in the form of levee and other agricultural maintenance activities. These are ongoing activities and Swainson's hawk nesting habitat has existed under this condition over time. Nevertheless, because levee maintenance could result in the removal of trees with active nests, and therefore could result in the loss of a state-listed species, this effect is **significant**.

EFFECT BIO-7 Loss of Suitable Foraging and Nesting Habitat for Swainson's Hawk. *Under the No-Action Alternative, there would be no project-related construction, conversion, modification, or loss of suitable foraging and/or nesting habitat for Swainson's hawk. Agricultural land uses are known to provide suitable foraging habitat and nesting habitat has existed on the project islands under the current agricultural management condition over time. Therefore, this effect is less than significant.*

Under the No-Action Alternative, there would be no project-related construction, conversion, modification, or loss of suitable foraging and/or nesting habitat for Swainson's hawk. Agricultural land uses are known to provide suitable foraging habitat and nesting habitat has existed on the islands under the current agricultural management condition over time. Therefore, this effect is **less than significant**.

EFFECT BIO-8 Loss of Foraging Habitats for Migratory or Wintering Waterfowl. *Under the No-Action Alternative, there would be no project-related construction, conversion, modification, or loss of suitable foraging and/or nesting habitat to migratory or wintering waterfowl. Adverse effects to waterfowl and their habitat would continue to be present in the form of agricultural activities; however, these are ongoing activities and habitat for waterfowl has existed under this condition over time. Further, migratory and wintering waterfowl are dependent on a variety of wetland and* *upland habitat types in the Delta, including agricultural crops (primarily corn and wheat) for forage, which would continue to be present under the No-Action Alternative. Therefore, this effect is less than significant.*

Under the No-Action Alternative, there would be no project-related construction, conversion, modification, or loss of suitable foraging and/or nesting habitat to migratory or wintering waterfowl. Adverse effects to waterfowl and their habitat would continue to be present in the form of agricultural activities; however, these are ongoing activities and habitat for waterfowl has existed under this condition over time. Further, migratory and wintering waterfowl are dependent on a variety of wetland and upland habitat types in the Delta, including agricultural crops (primarily corn and wheat) for forage, which would continue to be present under the No-Action Alternative. Therefore, this effect is **less than significant**.

EFFECT BIO-9

Increase in Suitable Foraging Habitat for Greater Sandhill Crane. *Under the No-Action Alternative, there would be no project-related construction or operational effects to greater sandhill crane or its suitable habitat. Adverse effects to sandhill crane and its habitat would continue to be present in the form of agricultural activities; however, these are ongoing activities and habitat for sandhill crane has existed under this condition over time. Further, greater sandhill crane forages in agricultural lands such as corn and grain fields, and pastures, which would continue to be present under the No-Action Alternative. Therefore, this effect is less than significant.*

Under the No-Action Alternative, there would be no project-related construction or operational effects to greater sandhill crane or its suitable habitat. Adverse effects to sandhill crane and its habitat would continue to be present in the form of agricultural activities; however, these are ongoing activities and habitat for sandhill crane has existed under this condition over time. Further, greater sandhill crane forage in agricultural lands such as corn and grain fields, and pastures, which would continue to be present under the No-Action Alternative. Therefore, this effect is **less than significant**.

EFFECT BIO-10

Potential Injury or Mortality to Migratory Birds. *Under the No-Action Alternative, there would be no project-related construction or operational effects to migratory birds or suitable habitat. Adverse effects to migratory birds and their habitat would continue to be present in the form of levee and other agricultural maintenance activities; however, these are ongoing activities and habitat for migratory birds has existed under this condition over time. Nevertheless, because levee maintenance and agricultural activities could result in the destruction of active nests, this effect is significant.*

Under the No-Action Alternative, there would be no project-related construction and operational effects to migratory birds or suitable habitat. Adverse effects to migratory birds protected under the Migratory Bird Treaty Act would continue to be present in the form of levee and other agricultural maintenance activities; however, these are ongoing activities and habitat for migratory birds has existed under this condition over time. Nevertheless, because levee maintenance and agricultural activities could result in the direct destruction of active nests and therefore loss of migratory birds, this effect is **significant**.

Alternative 1 and Alternative 2 (Proposed Action)

The effect analysis and mitigation measures for Alternatives 1 and 2 are the same; therefore, they are described together under this heading. Development of the Reservoir Islands would result in the inundation of suitable habitat for terrestrial species of plants and wildlife, including special-status species. Effects to habitats on the Reservoir Islands under Alternatives 1 and 2 are summarized in Table 3.5-5a. Effects to habitats on the Habitat Islands under Alternatives 1 and 2 are summarized in Table 3.5-5b. Some areas of the Habitat Islands (primarily cropland and fallow habitats) would be converted to wetland habitats. Details on where habitat would be created on the Habitat Islands may be found in the Draft CMP (Appendix B).

Table 3.5-5a
Affected Habitat Types at the Reservoir Islands Under Alternatives 1 and 2 (Proposed Action)

Habitat Type	Bacon Island	Webb Tract	Total
Upland Communities			
Perennial grassland	385.7	762.8	1,148.5
Cropland	4,469.6	3,045.4	7,515.0
Fallow	0	57.4	57.4
Urban/disturbed	156.0	33.3	189.3
Aquatic Communities			
Freshwater marsh	116.9	159.0	275.9
Farmed wetland	406.5	1,100.5	1,506.9
Forested wetland	18.0	203.9	221.9
Tidal marsh	0.8	0.2	1.0
Drainage ditch	27.2	33.6	60.8
Permanent ponds	0.2	83.3	83.5
Tidal channel	3.1	3.2	6.4
Total	**5,584.0**	**5,482.6**	**11,066.6**

Note: Totals subject to rounding

Sources: ICF 2010:4.6-23; data compiled by Environmental Science Associates in 2013

Table 3.5-5b
Affected Habitat Types at the Habitat Islands Under Alternatives 1 and 2 (Proposed Action)

Habitat Type	Bouldin Island	Holland Tract	Total[1]
Upland Communities			
Perennial grassland	50.61	0.0	50.6
Cropland	2,179.6	0.0	2,179.6
Fallow	0.0	0.0	0.0
Urban/disturbed	0.0	0.0	0.0
Aquatic Communities			
Freshwater marsh	3.3	8.4	11.6
Farmed wetland	71.9	616.6	688.5
Forested wetland	0.0	1.2	1.2
Tidal marsh	0.0	0.0	0.0
Drainage ditch	4.2	0.0	4.2
Permanent ponds	0.0	0.0	0.0
Tidal channels	0.0	0.0	0.0
Total	**2,309.6**	**626.1**	**2,935.7**

Notes: Totals subject to rounding

[1] Affected acreage to upland and aquatic communities on the Habitat Islands primarily results from enhancement and/or conversion to other community types; the resulting acreages and associated habitat values are described in further detail in the Draft CMP (Appendix B).

Sources: ICF 2010:4.6-23; data compiled by Environmental Science Associates in 2013

EFFECT BIO-1 Introduction and Spread of Invasive Plants. *Habitat for special-status species could become degraded and thus unsuitable; therefore, construction activities and operations that may introduce or facilitate the spread of invasive plant species would adversely affect habitat for special-status species. This effect is less than significant.*

Implementation of Alternative 1 or 2 may facilitate the spread of existing invasive plants and introduce invasive plants to previously uninvaded areas. Flooding and earthmoving activities during construction are potential mechanisms for the introduction of invasive plants. Invasive plants are known to disrupt natural ecosystems, obstruct navigation, and reduce the suitability of habitats for special-status species. The introduction and spread of invasive plants may also result in a substantial adverse effect on wetlands and other waters of the U.S. through the removal of native species and hydrological changes.

As outlined in the Environmental Commitments for the project, the Final CMP would include long-term management goals to address invasive plants on both the Habitat and Reservoir Islands. The measures adopted in the Final CMP would have an emphasis on an adaptive management approach but would focus on prevention and early detection of new infestations, as well as physical, chemical, and biological control measures. The Final CMP would also describe long-term monitoring of special-status species habitat for invasive plants with a focus on early detection and management of new invasive plant populations.

Because the Final CMP would be implemented as part of the project as an Environmental Commitment, the adverse effect from introduction and spread of invasive plants during construction is **less that significant**.

Mitigation Measure: No mitigation is required.

EFFECT BIO-2 Loss of Special-Status Plants. *Construction of the Reservoir Islands may adversely affect existing populations of special-status plants, including Mason's lilaeopsis. This effect is potentially significant.*

Populations of Mason's lilaeopsis were observed along the exterior levee slopes of Bacon Island and Webb Tract during special-status plant surveys conducted in 1988, 1994, and 2004. Project facilities have been designed to avoid these populations. However, under Alternatives 1 or 2, the siting of a pump station, siphon station, or other project facility on a site that may have become occupied by special-status plants that were not observed during the surveys could result in the loss of individual plants or populations. Contra Costa wallflower, Delta button-celery, Bogg's Lake hedge-hyssop, Mason's lilaeopsis, and Antioch Dunes evening-primrose are all known to occur in the Delta region, and suitable habitat for Bogg's Lake hedge-hyssop and Mason's lilaeopsis is present on the project islands. This effect is **potentially significant**.

Mitigation Measure BIO-MM-1: Implement Pre-Construction Surveys, Avoidance, and Compensation for Project Effects to Special-Status Plants.

Before the initiation of any vegetation removal or ground-disturbing activities in areas that provide suitable habitat for special-status plants, the following measures shall be implemented by the project applicant:

- A qualified botanist will conduct appropriately-timed surveys for special-status plant species, including those identified in Table 3.5-2, in all suitable habitat that would be potentially disturbed by the project.
- Surveys shall be conducted following USFWS and DFW or approved protocols.
- If no special-status plants are found during focused surveys, the botanist shall document the findings in a letter to the appropriate agencies (DFW for state-listed species and USFWS for Federally listed species) and the project applicant, and no further mitigation will be required.

If special-status plants are found during focused surveys, the following measures shall be implemented:

- Information regarding the special-status plant population shall be submitted to the CNDDB.
- If the populations can be avoided during project implementation, they shall be clearly marked in the field by a qualified botanist and avoided during construction activities. Before ground clearing or ground disturbance, all on-site construction personnel shall be instructed as to the species' presence and the importance of avoiding this species and its habitat.
- If special-status plant populations cannot be avoided, consultations with DFW and/or USFWS (depending on the listing status of the special-status plant) will take place. A plan to compensate for the loss of special-status plant species will be prepared, if required by DFW and/or USFWS, detailing appropriate replacement ratios, methods for implementation, success criteria, monitoring and reporting protocols, and contingency measures that would be implemented if the initial mitigation fails; the plan would be developed prior to the start of local construction activities and will be implemented concurrently with other project construction.
- If mitigation is required, the project applicant shall maintain and monitor the mitigation area for 5 years following the completion of construction and restoration activities. Monitoring reports shall be submitted to DFW and/or USFWS (depending on the listing status of the special-status plant being mitigated) at the completion of restoration and for the following 5 years. Monitoring reports shall include photodocumentation, planting specifications, a site layout map, descriptions of materials used, and justification for any deviations from the mitigation plan. If the monitoring indicates that the mitigation is not meeting the success criteria included in the mitigation plan, remedial measures shall be recommended.
- If remedial measures are recommended, the project applicant shall implement the remedial actions and continue annual monitoring and reporting until performance criteria have been met and the resource agencies (DFW for state-listed species and USFWS for Federally listed species) have deemed the mitigation adequate and complete.
- Monitoring and reporting may be considered adequate prior to the 5-year mark following the last implementation action, if plants are well established self-sustaining at the performance level targeted for the mitigation. This would require verification by the resource agencies (DFW for state-listed species and USFWS for Federally listed species).

Implementation of Mitigation Measure BIO-MM-1 would reduce potentially significant effects to special-status plants to a **less-than-significant** level because surveys would be conducted prior to construction to identify and protect (i.e., avoid) any potential special-status plants. If plants are found and cannot be avoided, a plan would be prepared and implemented to compensate for any loss.

EFFECT BIO-3	Potential Injury or Mortality of, and Potential Loss of Suitable Habitat for, Valley Elderberry Longhorn Beetle. *Elderberry shrubs are present on Holland Tract, and construction-related activities may adversely affect VELB. This effect is significant.*

Under Alternatives 1 and 2, habitat creation and modification on Holland Tract could result in disturbance or mortality of VELB or its habitat, if elderberry shrubs are removed or trimmed, or the roots of the shrubs are cut or disturbed. As outlined in the "Environmental Commitments" subsection above, avoidance and protection measures would be included in the Construction Implementation Plan to protect VELB and its habitat. However, VELB is a Federally listed species, and without more specific measures to protect VELB, this effect is **significant**.

Mitigation Measure BIO-MM-2: Implement Protection, Restoration, and Maintenance Measures for Valley Elderberry Longhorn Beetle.

The project applicant, in consultation with USFWS, will implement the following protective measures for elderberry shrubs on Holland Tract during habitat construction activities:

Protective Measures:

1. Fence and flag all areas to be avoided during construction activities. In areas where encroachment on the 100-foot buffer area has been approved by USFWS, provide a minimum setback of at least 20 feet from the drip line of each elderberry plant.

2. Following the environmental construction worker training to be outlined in the Construction Implementation Plan, brief contractors on the need to avoid damaging the elderberry plants and the possible penalties for not complying with these requirements. Instruct work crews about the status of the beetle and the need to protect its elderberry host plant.

3. Erect signs every 50 feet along the edge of the avoidance area with the following information: "This area is habitat of the valley elderberry longhorn beetle, a threatened species, and must not be disturbed. This species is protected by the Endangered Species Act of 1973, as amended. Violators are subject to prosecution, fines, and imprisonment." The signs should be clearly readable from a distance of 20 feet, and must be maintained for the duration of construction.

Compensation:
If elderberry plants within the buffer area are damaged during construction or cannot be avoided, the project applicant shall consult with USFWS to determine appropriate compensation. This may include transplanting elderberry plants that cannot be avoided or replacement of damaged elderberry plants at a location approved by USFWS.

Restoration and Maintenance:

4. Restore any damage that occurs in the buffer area (area within 100 feet of elderberry plants) during construction. Provide erosion control and revegetate with appropriate native plants.

5. The project applicant must provide a written description of how the buffer areas are to be restored, protected, and maintained after construction is completed. This shall be included in the Construction Implementation Plan.

6. No insecticides, herbicides, fertilizers, or other chemicals that might harm the beetle or its host plant should be used in the buffer areas, or within 100 feet of any elderberry plant with one or more stems measuring 1.0 inch or greater in diameter at ground level.

7. Mowing of grasses/ground cover may occur from July through April to reduce fire hazard. No mowing should occur within 5 feet of elderberry plant stems. Mowing must be performed in a manner that avoids damaging plants (e.g., stripping away bark through careless use of mowing/trimming equipment).

Implementation of Mitigation Measure BIO-MM-2 would reduce significant effects to VELB from loss of suitable habitat to a **less-than-significant** level because the project would implement protection, restoration, and maintenance measures for all VELB that may be affected by the project.

EFFECT BIO-4 **Potential Injury or Mortality of Giant Garter Snake.** *Suitable habitat for giant garter snake is present on the project islands, and construction activities could result in the incidental take of giant garter snake. This effect is significant.*

Under Alternatives 1 and 2, activities associated with reservoir construction, as well as habitat creation and modification, could incidentally result in injury or mortality of giant garter snakes if they are present within suitable aquatic and upland habitat on the islands. However, it is unlikely that there is a self-sustaining giant garter snake population on the islands because the islands are surrounded by canals and rivers and because past surveys did not discover the snake. Although there is low potential for injury or mortality of a giant garter snake during construction activities, the loss of an individual snake would be considered a significant effect because giant garter snake populations have declined substantially throughout its range because of habitat loss and fragmentation from urban development and mortality as a result of water conveyance channel maintenance, leading to its Federal and state listing as threatened (U.S. Fish and Wildlife Service 1999). As outlined in the "Environmental Commitments" subsection above, avoidance and minimization measures that are part of the Construction Implementation Plan would help to avoid or reduce the potential for injury or mortality of giant garter snakes. However, without more specific measures to protect giant garter snake, this effect is **significant**.

Mitigation Measure BIO-MM-3: Implement Protection Measures for Giant Garter Snake.

1. All construction activity within giant garter snake habitat shall be conducted between May 1 and October 1. For any construction activities that would need to take place between October 2 and April 30, the applicant will contact USFWS to determine if additional measures are necessary to minimize and avoid take. If additional measures are deemed necessary, the applicant will implement these measures as required by USFWS.

2. Any dewatered habitat must remain dry for at least 15 consecutive days after April 15 and prior to excavating or filling of the dewatered habitat.

3. Construction personnel shall participate in a USFWS-approved worker environmental awareness program. Under this program, workers shall be informed about the presence of giant garter snakes and habitat associated with the species and that unlawful take of the animal or destruction of its habitat is a violation of the Act. Prior to construction activities, a qualified biologist approved by USFWS shall instruct all construction personnel about: (1) the life history of the giant garter snake; (2) the importance of irrigation canals, marshes/wetlands, and seasonally flooded areas, such as rice fields, to the giant garter snake; and (3) the terms and conditions of the biological opinion (as applicable). Proof of this instruction shall be submitted to USFWS.

4. Within 24-hours prior to commencement of construction activities, the site shall be inspected by a USFWS-approved biologist. The biologist will provide the USFWS with a field report form documenting the monitoring efforts within 24 hours of commencement of construction activities. The monitoring biologist needs to be available thereafter; if a snake is encountered during construction activities, the monitoring biologist shall have the authority to stop construction activities until appropriate corrective measures have been completed or it is determined that the snake will not be harmed. Giant garter snakes encountered during construction activities should be allowed to move away from construction activities on their own. The biologist shall be required to report any incidental take to the USFWS immediately. The project area shall be re-inspected whenever a lapse in construction activity of 2 weeks or greater has occurred.

5. Clearing of wetland vegetation will be confined to the minimal area necessary to excavate the toe of banks for riprap or fill placement. Excavation of channels for removal of accumulated sediments will be accomplished by using equipment located on and operated from the top of the bank, with the least interference practical for emergent vegetation.

6. Movement of heavy equipment to and from the project site shall be restricted to established roadways to minimize habitat disturbance.

7. Preserved giant garter snake habitat shall be designated as an "Environmentally Sensitive Area" and shall be flagged by a USFWS-approved biologist and avoided by all construction personnel.

8. After completion of construction activities, any temporary fill and construction debris shall be removed and, wherever feasible, disturbed areas shall be restored to pre-project conditions. Restoration work may include replanting emergent vegetation.

Implementation of Mitigation Measure BIO-MM-3 would reduce significant effects from injury or mortality to giant garter snake to a **less-than-significant** level because measures would be implemented to avoid and protect the species.

EFFECT BIO-5 — Loss of Suitable Aquatic and Upland Habitat for Giant Garter Snake. *Construction of the Reservoir Islands would result in the loss of suitable aquatic and upland habitat for giant garter snake. This effect is less than significant.*

Effects to giant garter snake would include the loss of aquatic and upland habitats on the Reservoir Islands under Alternatives 1 and 2. The Draft CMP (Appendix B) concludes that approximately 289.3 acres of giant garter snake aquatic habitat and 1,330.9 acres of upland habitat would be eliminated due to construction of the Reservoir Islands. The aquatic habitat effects were calculated using the information collected by DWR in 2002 and 2003, which quantifies the amount of moderate and high quality aquatic habitat for giant garter snake on the Reservoir Islands, along with the extent of existing aquatic features and suitable wetland types (i.e., ponds, canals, ditches, and freshwater marsh) identified in the verified 2012 wetland delineation. Giant garter snake upland habitat on the Habitat Islands was calculated by including upland habitat within 200 feet of potentially suitable aquatic habitat. All existing giant garter snake aquatic habitat on the Habitat Islands would be preserved and protected.

As shown in Table 3.5-6, implementation of the Draft CMP and Conceptual Restoration Plans would result in a substantial net increase in aquatic habitat for giant garter snake on the Habitat Islands when compared to the existing conditions on all project islands (see the CMP contained in Appendix B for the methodology and results of post-project acreage calculations), and the post-project acreage of upland habitat would be greater than the acres affected by the project. In addition, created habitat, including upland habitat, would be of substantially higher value than existing conditions because it would be managed specifically for the requirements of this species. Currently, most existing upland habitat is disturbed due to regular farming activities. With the implementation of this compensation under the CMP for project effects to giant garter snake habitat, which has been incorporated into the project as an Environmental Commitment, there would be a net increase in suitable habitat for giant garter snake on the Habitat Islands, and on Holland Tract in particular. Therefore, the loss of aquatic and upland habitat for giant garter snake is a **less-than-significant** effect.

Table 3.5-6
Giant Garter Snake Habitat Effects Under Alternatives 1 and 2 (Proposed Action)

Habitat Type	Vegetation Communities	Acres Existing	Acres Affected	Acres Created	Acres Preserved	Acres Post-Project
Aquatic	Freshwater marsh, canals/ditches, and ponds	734.2	289.3	1,168.2	442.4	1,610.6
Upland	Herbaceous upland, farmed upland	2,582.0	1,330.9	1,489.1	494.5	1,983.6

Source: Data compiled by Environmental Science Associates in 2013

Mitigation Measure: No mitigation is required.

EFFECT BIO-6 | Potential Injury or Mortality of Swainson's Hawk. *Suitable nesting habitat is present on the project islands, and construction activities may result in the incidental take of active nest sites. This effect is significant.*

Construction activities such as refurbishing and enlarging levees, construction of facilities, installation of Reservoir Island infrastructure, and grading to create habitats on the Habitat Islands may result in the incidental take of nesting hawks through the removal of tress with active nests. This effect is **significant**.

Mitigation Measure BIO-MM-4: Implement Protection Measures for Swainson's Hawk.

1. No more than 30 days prior to construction, suitable Swainson's hawk nesting habitat in the construction area and within a buffer of 1/2 mile will be surveyed by a qualified biologist during the breeding season. The survey will be performed in accordance with DFW's Recommended Timing and Methodology for Swainson's Hawk Nesting Surveys in California's Central Valley. Any active nest sites will be documented and protected per the requirements in (2), below. The results of the survey will be documented in a report to be submitted to DFW.

2. No construction activities should be initiated within 1/2 mile (i.e., the buffer zone) of an active nest between March 1 and September 15. If construction or other project-related activities that may cause nest abandonment or forced fledging are necessary within the buffer zone, with DFW approval, the nest site may be monitored by a qualified biologist with authority to stop construction should the hawks show signs of stress, such as nest abandonment and loss of young.

Implementation of Mitigation Measure BIO-MM-4 would reduce significant effects from injury or mortality of Swainson's hawk during construction activities to a **less-than-significant** level because nesting surveys would be conducted and construction activities would be limited in the vicinity of active nests.

EFFECT BIO-7 | Loss of Suitable Foraging and Nesting Habitat for Swainson's Hawk. *Development of the Reservoir Islands would result in a loss of suitable foraging and nesting habitat for Swainson's hawk. This effect is less than significant.*

As shown in Table 3.5-7, suitable nesting and foraging habitat for Swainson's hawk would be adversely affected by the construction of the Reservoir Islands under Alternatives 1 and 2. However, nesting and foraging habitat on the Habitat Islands would be created through implementation of the Draft CMP.

Table 3.5-7
Swainson's Hawk Habitat Effects Under Alternatives 1 and 2 (Proposed Action)

Habitat Type	Acres Existing	Acres Affected	Acres Created	Acres Preserved	Post-Project Acreage
Nesting	212.2	120.4	400.0	91.8	491.8
Foraging	18,598.2	11,968.9	2,788.9	3,509.8	6,298.7

Source: Data compiled by Environmental Science Associates in 2013

The Conceptual Restoration Plans (Appendix B) provide a discussion of suitable habitat for Swainson's hawk and the methodology used for the design of compensatory habitats. The establishment of cottonwood-willow forest habitat on Bouldin Island would provide a substantial amount of additional nesting habitat for Swainson's hawk over time. In addition, creation and revegetation of herbaceous upland on the Habitat Islands, along with appropriate management of agricultural lands (including farmed wetlands), would provide higher quality foraging habitat when compared to habitats that would be lost on the Reservoir Islands. As discussed previously, currently most agricultural lands on the project islands are planted with corn. Corn provides low value as foraging habitat because it becomes largely inaccessible to foraging Swainson's hawks as it matures. With implementation of the Draft CMP, which has been incorporated into the project as an Environmental Commitment, agricultural land on Bouldin Island would be planted with crop types that are more conducive to high-quality foraging habitat for Swainson's hawk, including row crops such as alfalfa, safflower, and tomatoes. Therefore, although the post-project acreage of Swainson's hawk foraging habitat is less than the existing habitat acreage, the post-project uplands would be specifically designed and managed for Swainson's hawk foraging habitat through selection of appropriate crop types and upland restoration species, and regular mowing of restored upland grasslands, thereby providing substantially higher habitat value. Therefore, the loss of suitable nesting and foraging habitat on the Reservoir Islands is a **less-than-significant** effect.

Mitigation Measure: No mitigation is required.

EFFECT BIO-8 Loss of Foraging Habitats for Migratory or Wintering Waterfowl. *The project islands provide winter foraging habitat for migratory waterfowl and are located within the Pacific Flyway; therefore, construction may result in a loss in habitat for migratory or wintering waterfowl. This effect is less than significant.*

Migratory and wintering waterfowl are dependent on a variety of wetland and upland habitat types in the Delta, including agricultural crops (primarily corn and wheat) for forage. Water storage operations on the Reservoir Islands would decrease the amount of agricultural crops on the Reservoir Islands. However, the Draft CMP and Draft CMP, which have been incorporated into the project as an Environmental Commitment, include intensive management of a mix of agriculture, seasonal wetland, freshwater marsh, and farmed wetlands on the Habitat Islands that would provide high-quality waterfowl forage values. Small grain fields, seasonal ponds, permanent lakes, emergent marshes, and herbaceous uplands would provide foraging areas for migrating or wintering waterfowl on the Habitat Islands. In addition, the Reservoir Islands would still provide seasonal open water habitat for waterfowl. With an increase in wetland habitats as compared to existing conditions, Alternatives 1 and 2 would not result in a net loss of wintering habitat for waterfowl. Therefore, this effect is **less than significant**.

Mitigation Measure: No mitigation is required.

EFFECT BIO-9 Increase in Suitable Foraging Habitat for Greater Sandhill Crane. *Existing foraging habitat for greater sandhill crane on the Reservoir Islands would be lost, but construction of the Habitat Islands would result in an increase in foraging habitat for this species. This effect is less than significant and beneficial.*

Greater sandhill crane forages in corn and grain fields, wetlands, pastures, and herbaceous uplands. Under Alternatives 1 and 2, suitable greater sandhill crane foraging habitat would be lost on the Reservoir Islands. The Draft CMP includes substantial freshwater marsh creation on Holland Tract and agricultural preservation on Bouldin Island. Both of these habitat types provide important habitat elements for this species: freshwater marsh is used for roosting, loafing and foraging, while cereal crops provide important winter forage. Post-project roosting habitat (freshwater marsh) on the Habitat Islands would be approximately 1,334 acres. Post-project foraging habitat would be approximately 7,712 acres and would consist of farmed wetlands, freshwater marsh, seasonal wetlands, fallow, cropland, and perennial grassland on the Habitat Islands. Additionally, approximately 11,053 acres of open water on the Reservoir Islands (once constructed) and in permanent ponds on the Habitat Islands would be available for loafing. As described in the Conceptual Restoration Plans (Appendix B), nesting and foraging habitat would be managed specifically for wildlife habitat, and would be of substantially higher value when compared to existing conditions. Because of this net increase in wetland habitat and conservation of agricultural lands, this effect is **less than significant** and would be **beneficial** in the long-term due to the higher value of post-project habitats.

Mitigation Measure: No mitigation is required.

EFFECT BIO-10 — **Potential Injury or Mortality to Migratory Birds.** *The project islands provide suitable nesting habitat for birds protected under the Migratory Bird Treaty Act, and project-related construction may result the take of protected birds defined therein. This effect is significant.*

Construction activities associated with refurbishing and enlarging levees, installing project infrastructure, and grading to establish Habitat Island habitats could result in temporary effects on bird species protected under the MBTA. Construction disturbance during the breeding season could result in the incidental loss of fertile eggs or nestlings or otherwise lead to nest abandonment of various species. Construction activities also could disturb roosting greater sandhill cranes, or disturb California black rails nesting in Delta channels adjacent to the project islands. As outlined in the "Environmental Commitments" subsection above, avoidance and minimization measures that are part of the Construction Implementation Plan would be implemented avoid or reduce the potential for injury or mortality of migratory bird species. However, without more specific measures to protect active nest sites from construction activities, this effect is **significant**.

Mitigation Measure BIO-MM-5: Implement Protection Measures for Migratory Birds.

1. No more than 30 days prior to construction, suitable nesting habitat in the construction area and within a 500-foot buffer will be surveyed by a qualified biologist during the breeding season to identify any active nest sites. Any active nest sites will be documented and protected per the requirements of (2), below. The results of the survey will be documented in a report to be submitted to DFW.

2. No construction activities should be initiated within 500 feet of an active nest between March 1 and August 15. If construction or other project related activities that may cause nest abandonment or forced fledging are necessary within the buffer zone, with DFW approval, the nest site may be monitored by a qualified biologist with authority to stop construction should birds show signs of stress such as nest abandonment and loss of young.

Implementation of Mitigation Measure BIO-MM-5 would reduce significant effects from injury or mortality of migratory birds to a **less-than-significant** level because nesting surveys would be conducted and construction activities would be limited in the vicinity of active nests.

Alternative 3

Potential effects to habitats on Bacon Island and Webb Tract under Alternative 3 would be similar to those described under Alternatives 1 and 2. However, Alternative 3 would also include the use of Holland Tract and the southern portion of Bouldin Island as Reservoir Islands, resulting in substantially greater direct effects to biological resources when compared to Alternative 1 or 2. In addition, this alternative would provide relatively little on-site preservation, with the habitat creation being limited to the NBHA. Effects to habitats on the project islands under Alternative 3 are summarized in Table 3.5-8.

Table 3.5-8
Affected Habitat Types on all Project Islands Under Alternative 3

Habitat Type	Bacon Island (Acres)	Webb Tract (Acres)	Holland Tract (Acres)	Bouldin Island (Acres)	Total (Acres)
Upland Communities					
Perennial grassland	385.7	762.8	94.4	521.2	1,764.1
Cropland	4,469.6	3,045.4	0	3,915.9	11,430.9
Fallow	0	57.4	1,928.0	0	1,985.4
Urban/disturbed	156.0	33.3	0	60.7	250.0

Table 3.5-8 Affected Habitat Types on all Project Islands Under Alternative 3					
Habitat Type	Bacon Island (Acres)	Webb Tract (Acres)	Holland Tract (Acres)	Bouldin Island (Acres)	Total (Acres)
Aquatic Communities					
Freshwater marsh	116.9	159.0	172.8	122.6	571.3
Farmed wetland	406.5	1,100.5	614.6	381.6	2,503.2
Forested wetland	18.0	203.9	108.7	10.5	341.1
Tidal marsh	0.8	0.2	0	0	1.0
Drainage ditch	27.2	33.6	18.8	44.1	123.7
Permanent ponds	0.2	83.3	68.6	1.0	153.1
Tidal channel	3.1	3.2	0	0	6.3
Total	**5,584.0**	**5,482.6**	**3,005.9**	**5,057.6**	**19,130.1**
Sources: Data compiled by ICF in 2010 and Environmental Science Associates in 2013					

EFFECT BIO-1 Introduction and Spread of Invasive Plants. *Project-related construction activities and operations that may introduce or facilitate the spread of invasive plant species would adversely affect habitat for special-status species. This effect is less than significant.*

Implementation of Alternative 3 may facilitate the spread of existing invasive plants and introduce new invasive plants to previously uninvaded areas during construction activities such as flooding and earth moving. Under Alternative 3, mitigation for effects to special-status species habitat would occur within the NBHA and at off-site locations. As outlined in the Environmental Commitments for the project, the Final CMP would describe the long-term maintenance and management of special-status species habitat within the mitigation areas and would include long-term management goals to address invasive plants that focus on early detection and management of new invasive plant populations. Because the Final CMP would be implemented as part of the project as an Environmental Commitment, the introduction and spread of invasive plants is a **less-than-significant** effect.

Mitigation Measure: No mitigation is required.

EFFECT BIO-2 Loss of Special-Status Plants. *Construction of the Reservoir Islands may adversely affect existing populations of special-status plants, including Mason's lilaeopsis. This effect is potentially significant.*

The effects of Alternative 3 pertaining to special-status plants are the same as those described for Alternatives 1 and 2. Mason's lilaeopsis was observed along exterior levee slopes on Webb Tract, Bacon Island, and Bouldin Island during special-status plant surveys in 1988, 1994, and 2004. Although the project has been designed to avoid known populations, the siting of project facilities in a location that may now be occupied by special-status plants that were not observed during the prior surveys could result in the loss of individual plants or populations. Contra Costa wallflower, Delta button-celery, Bogg's Lake hedge-hyssop, Mason's lilaeopsis, and Antioch Dunes evening-primrose are all known to occur in the Delta region, and suitable habitat for Bogg's Lake hedge-hyssop and Mason's lilaeopsis is present on the project islands. In addition, Alternative 3 requires additional off-site mitigation at a location yet to be determined. This location could support additional special-status plant species that could be adversely affected by project implementation. This effect is **potentially significant.**

Mitigation Measure: Implement Mitigation Measure BIO-MM-1 (Implement Pre-Construction Surveys, Avoidance, and Compensation for Project Effects to Special-Status Plants).

Implementation of Mitigation Measure BIO-MM-1 would reduce the potentially significant effect from loss of special-status plants to a **less-than-significant** level because surveys would be conducted prior to construction to identify and protect (i.e., avoid) any potential special-status plants. If plants are found and cannot be avoided, a plan would be prepared and implemented to compensate for any loss. Surveys and mitigation plans would include any new areas not surveyed to date.

EFFECT BIO-3 Potential Injury or Mortality of, and Potential Loss of Suitable Habitat for, Valley Elderberry Longhorn Beetle. *Elderberry shrubs are present on Holland Tract, and therefore reservoir construction activities may adversely affect VELB, which is Federally listed as threatened. This effect is significant.*

Conversion of a portion of Holland Tract to a Reservoir Island would result in the loss of elderberry shrubs that provide suitable habitat for VELB. The removal or flooding of elderberry shrubs could result in the injury or mortality of VELB. As described in the "Environmental Commitments" subsection above, avoidance and minimization measures would be included in the Construction Implementation Plan that would help to avoid and protect VELB and its habitat. However, without more specific measures, this effect is **significant**.

Mitigation Measure: Implement Mitigation Measure BIO-MM-2 (Implement Protection, Restoration, and Maintenance Measures for Valley Elderberry Longhorn Beetle).

Mitigation Measure BIO-MM-6: Compensate for Loss of Habitats for Special-Status Species and Migratory and Wintering Birds through an Off-Site Compensatory Mitigation Site.

The project applicant, in consultation with USACE, DFW, and USFWS, will develop and implement an off-site compensatory mitigation plan to mitigate effects on habitats for special-status species and habitats. The mitigation area(s) will be located in San Joaquin and/or Contra Costa County and in the Delta, unless otherwise approved by DFW and USFWS. The plan will include adequate compensation to ensure no net loss of habitat, as well as provisions for long-term monitoring of the habitat mitigation areas to determine species' use of the of the area and to ensure that habitats are being managed appropriately for species included in the plan. Monitoring reports will be prepared and submitted to DFW and USFWS on a schedule to be determined in consultation with the agencies. No water diversion/storage will be permitted until the mitigation plan and mitigation implementation schedule has been approved by the DFW and USFWS. In general, the plan will include the specifications and measures as described in the Draft CMP for Alternatives 1 and 2; however, mitigation ratios may be modified during consultation with DFW and USFWS and mitigation may take place on other islands in the Delta, including areas of Chipps Island that are owned by the project applicant.

Implementation of Mitigation Measures BIO-MM-2 and BIO-MM-6 would reduce the direct, significant effect from injury or mortality of, and potential loss of suitable habitat for, VELB to a **less-than-significant** level because the project would implement protection, restoration, and maintenance measures for VELB and the project would develop and implement an off-site compensatory mitigation for VELB.

EFFECT BIO-4 Potential Injury or Mortality of Giant Garter Snake. *Suitable habitat for giant garter snake is present on the project islands, and construction activities could result in the incidental take of giant garter snake. This effect is significant.*

Alternative 3 may result in incidental injury or mortality of giant garter snakes as described for Alternatives 1 and 2. The magnitude of the effect could be greater under Alternative 3 because more of the islands would be affected. As outlined in the "Environmental Commitments" subsection above, avoidance and minimization measures that are part of the Construction Implementation Plan would help to avoid or reduce the potential for injury or mortality of giant garter snakes. However, without more specific measures to protect giant garter snake, this effect is **significant**.

Mitigation Measure: Implement Mitigation Measure BIO-MM-3 (Implement Protection Measures for Giant Garter Snake).

Implementing Mitigation Measure BIO-MM-3 would reduce the significant effect from injury or mortality of giant garter snake to a **less-than-significant** level because measures would be implemented to avoid and protect the species.

EFFECT BIO-5 Loss of Suitable Aquatic and Upland Habitat for Giant Garter Snake. *Construction of the Reservoir Islands would result in the direct loss of suitable aquatic and upland habitat for giant garter snake. This effect is significant.*

According to information gathered by DWR in 2002 and 2003 (California Department of Water Resources 2003, 2006, and unpublished information), a total of 647.6 acres of suitable aquatic habitat could be lost from the project islands as a result of the implementation of Alternative 3 (Table 3.5-9). Approximately 2,309 acres of suitable upland habitat would also be lost from the four project islands from implementation of Alternative 3. The NBHA would allow for the conservation and protection of some aquatic and upland habitat for this species. However, the loss of large quantities of aquatic and upland habitats under Alternative 3 is a **significant** effect.

Table 3.5-9
Giant Garter Snake Habitat Effects Under Alternative 3

Habitat Type	Vegetation Communities	Acres Existing	Acres Affected	Acres Created	Acres Preserved	Acres Post-Project
Aquatic	Freshwater marsh, canals/ditches, and ponds	734.2	647.6	0	86.6	86.6
Upland	Herbaceous upland, farmed upland	2,582.0	2,309.0	0	273.0	273.0
Total		**3,316.2**	**2,956.6**	**0**	**359.6**	**359.6**

Source: Data compiled by Environmental Science Associates in 2013

Mitigation Measure: Implement Mitigation Measure BIO-MM-3 (Implement Protection Measures for Giant Garter Snake).

Mitigation Measure: Implement Measure BIO-MM-6 (Compensate for Loss of Habitats for Special-Status Species and Migratory and Wintering Birds through an Off-Site Compensatory Mitigation Site).

Implementing Mitigation Measures BIO-MM-3 and BIO-MM-6 would reduce the direct, significant effect from loss of suitable aquatic and upland habitat for giant garter snake to a **less-than-significant** level because measures would be implemented to avoid and protect the species and its habitat, and to compensate for loss of habitat.

EFFECT BIO-6 Potential Injury or Mortality of Swainson's Hawk. *Suitable Swainson's hawk nesting habitat is present on the project islands, and therefore construction activities may result in the incidental take of active nest sites. This effect is significant.*

Alternative 3 may result in the incidental take of nesting hawks through the removal of trees with active nests, as described for Alternatives 1 and 2. The magnitude of the effect could be greater under Alternative 3 because more of the project islands would be affected. As outlined in the "Environmental Commitments" subsection above, avoidance and minimization measures that are part of the Construction Implementation Plan would help to avoid or reduce the potential for injury or mortality of Swainson's hawk. Nonetheless, additional protection measures are needed to reduce or avoid potential incidental take of this species. This effect is **significant**.

Mitigation Measure: Implement Mitigation Measure BIO-MM-4 (Implement Protection Measures for Swainson's Hawk).

Implementing Mitigation Measure BIO-MM-4 would reduce the significant effect from injury or mortality of Swainson's hawk to a **less-than-significant** level because surveys would be conducted to identify and protect active nest sites during construction activities.

EFFECT BIO-7 Loss of Suitable Foraging and Nesting Habitat for Swainson's Hawk. *Development of the proposed reservoirs would result in a net decrease in available Swainson's hawk foraging and nesting habitat. This effect is significant.*

Implementation of Alternative 3 would result in the loss of approximately 17,684 acres of foraging habitat for Swainson's hawk and approximately 210 acres of suitable nesting habitat for Swainson's hawk (Table 3.5-10). The NBHA would allow for the conservation and protection of some foraging and nesting habitat for this species. This effect would otherwise be similar to that described for Alternatives 1 and 2. The loss of this large quantity of habitat is a **significant** effect.

Table 3.5-10
Swainson's Hawk Habitat Effects Under Alternative 3

Habitat Type	Acres Existing	Acres Affected	Acres Created	Acres Preserved	Post-Project Acreage
Nesting	212.2	210.1	0	2.2	2.2
Foraging	18,598.3	17,683.7	0	914.6	914.6

Source: Data compiled by Environmental Science Associates in 2013

Mitigation Measure: Implement Measure BIO-MM-6 (Compensate for Loss of Habitats for Special-Status Species and Migratory and Wintering Birds through an Off-Site Compensatory Mitigation Site).

Implementing Mitigation Measure BIO-MM-6 would reduce the direct, significant effect from loss of suitable Swainson's hawk foraging and nesting habitat to a **less-than-significant** level because the project would develop and implement an off-site compensatory mitigation site.

EFFECT BIO-8 Loss of Foraging Habitats for Migratory or Wintering Waterfowl. *The project islands provide winter foraging habitat for migratory waterfowl and are located within the Pacific Flyway, and therefore project construction activities may result in a loss in habitat for migratory or wintering waterfowl. This effect is significant.*

Implementation of Alternative 3 would result in the loss of low- to moderate-quality foraging habitats (i.e., cropland) for wintering waterfowl as described for Alternatives 1 and 2. However, Alternative 3 would result in a greater net loss of foraging habitat because portions of Holland Tract and Bouldin Island would be converted to seasonal reservoir shortage (in addition to Webb Tract and Bacon Island). While the seasonal reservoirs would still have value for waterfowl, the loss of grain crops would result in a decrease in high-quality foraging habitat for these species. The loss of this large quantity of foraging habitat is a **significant** effect.

Mitigation Measure: Implement Mitigation Measure BIO-MM-6 (Compensate for Loss of Habitats for Special-Status Species and Migratory and Wintering Birds through an Off-Site Compensatory Mitigation Site).

Implementation of Mitigation Measure BIO-MM-6 would reduce the direct, significant effect from loss of foraging habitats for migratory or wintering waterfowl to a **less-than-significant** level because the project would develop and implement an off-site compensatory mitigation site.

EFFECT BIO-9 **Loss of Suitable Foraging Habitat for Greater Sandhill Crane.** *The project islands provide foraging habitat for greater sandhill crane, and construction activities may result in a loss in foraging habitat for this species. This effect is significant.*

Implementation of Alternative 3 would result in a substantial loss of foraging habitat (i.e., agricultural lands and herbaceous upland) for greater sandhill crane as described under Alternatives 1 and 2. The loss of this large quantity of foraging habitat is a **significant** effect.

Mitigation Measure: Implement Measure BIO-MM-6 (Compensate for Loss of Habitats for Special-Status Species and Migratory and Wintering Birds through an Off-Site Compensatory Mitigation Site).

Implementing Mitigation Measure BIO-MM-6 would reduce the direct, significant effect from loss of suitable foraging habitat for greater sandhill crane to a **less-than-significant** level because the project would develop and implement an off-site compensatory mitigation site.

EFFECT BIO-10 **Potential Injury or Mortality to Migratory Birds.** *The project islands provide suitable nesting habitat for birds protected under the Migratory Bird Treaty Act, and construction activities may result the take of protected birds as defined therein. This effect is significant.*

Potential effects on special-status and non-special-status birds under Alternative 3 would be similar to Alternatives 1 and 2. As outlined in the "Environmental Commitments" subsection above, avoidance and minimization measures that are part of the Construction Implementation Plan would help to avoid or reduce the potential for injury or mortality of special-status and non-special-status birds. However, without more specific measures to protect active nest sites from construction activities, this effect is **significant**.

Mitigation Measure: Implement Mitigation Measure BIO-MM-5 (Implement Protection Measures for Migratory Birds).

Implementing Mitigation Measure BIO-MM-5 would reduce the significant effect of injury or mortality to migratory birds to a **less-than-significant** level because surveys would be conducted to identify and protect active nest sites during construction activities.

EFFECT BIO-11 **Habitat Conversion and Potential Effects on Associated Special-Status Species from Off-Site Mitigation.** *Implementation of off-site compensatory mitigation could result in habitat conversion and loss of associated special-status species. This effect is potentially significant.*

Alternative 3 requires off-site mitigation at a yet-to-be determined location in the Delta. Because the location for this mitigation is not known at this time, it is not possible to determine and quantify the specific effects associated with the mitigation. However, because activities associated with implementation of the off-site mitigation would be similar in nature to activities that would occur on the Habitat Islands under Alternatives 1 and 2, similar types of effects may occur. These include the following:

- loss of common and sensitive natural communities due to habitat conversion;
- loss of habitat for special-status plant and animal species, including the species discussed above under Alternatives 1 and 2; if different habitat types are affected by habitat conversion, additional species could be affected; and
- effects related to invasive weeds.

Therefore, depending on the ultimate location chosen and the potential presence of these resources, effects related to biological resources from implementation of off-site mitigation are **potentially significant**.

Mitigation Measure BIO-MM-7: Conduct Detailed Effects Assessment for Off-Site Mitigation Sites, Quantify Effects, and Include Necessary Mitigation in the Off-Site Compensatory Mitigation Plan.

If Alternative 3 is selected for implementation, the project applicant shall implement the following:

- determine the exact location for off-site mitigation;
- determine the habitat types that are present and assess their potential to support special-status species; this should include all species addressed under the effects analysis for Alternatives 1 and 2 but may include additional species, due to location or due to the presence of additional habitat types;
- assess the potential of the off-site mitigation site to support special-status species;
- conduct focused surveys for special-status species, if potential habitat is present;
- based on habitat mapping and focused surveys, quantify the effects to common and sensitive natural communities and special-status species according to same methodology used for Alternatives 1 and 2;
- include adequate mitigation in the off-site mitigation plan to account for habitat conversion and special-status species effects resulting from off-site mitigation, in addition to the effects on the project islands resulting from project implementation; and
- obtain regulatory agency approval for off-site mitigation plan prior to project implementation.

Implementation of Mitigation Measure BIO-MM-7 would reduce effects on special-status species and sensitive natural communities resulting from habitat conversion at the off-site mitigation site(s) to a **less-than-significant** level because the off-site compensatory mitigation plan (as required in Mitigation Measure BIO-MM-6) would be modified to include appropriate mitigation from any associated loss of habitat or special-status species.

Table 3.5-11
Comparison of Delta Wetlands Project 2001 FEIS and this SEIS Effects and Mitigation Measures for Biological Resources

2001 FEIS Effects and Mitigation Measures	SEIS Effects and Mitigation Measures
Alternatives 1 and 2 (Proposed Action)	
Impact G-3: Loss of Upland and Agricultural Habitats (LTS) **Mitigation**: No mitigation required	This effect is now covered under: **Effect BIO-3**: Potential Injury or Mortality of, and Potential Loss of Suitable Habitat for, Valley Elderberry Longhorn Beetle (LTS-M) **Mitigation Measure BIO-MM-2:** Implement Protection, Restoration, and Maintenance Measures for Valley Elderberry Longhorn Beetle. **Effect BIO-5**: Loss of Suitable Aquatic and Upland Habitat for Giant Garter Snake (LTS) **Mitigation:** No mitigation is required **Effect BIO-7**: Loss of Suitable Foraging and Nesting Habitat for Swainson's Hawk (LTS) **Mitigation:** No mitigation is required **Effect BIO-8**: Loss of Foraging Habitats for Migratory or

Table 3.5-11
Comparison of Delta Wetlands Project 2001 FEIS and this SEIS Effects and Mitigation Measures for Biological Resources

2001 FEIS Effects and Mitigation Measures	SEIS Effects and Mitigation Measures
	Wintering Waterfowl (LTS) **Mitigation:** No mitigation is required.
Impact G-4: Loss of Special-Status Plants (LTS-M) **Mitigation Measure G-1:** Site project Facilities to Avoid Special-Status Plant Populations **Mitigation Measure G-2:** Protect Special- Status Plant Populations from Construction and Recreational Activities **Mitigation Measure G-3:** Develop and Implement a Special-Status Plant Species Mitigation Plan	**Effect BIO-2:** Loss of Special-Status Plants (LTS-M) **Mitigation Measure BIO-MM-1:** Implement Pre-Construction Surveys, Avoidance, and Compensation for Project Effects to Special-Status Plants This mitigation measure has been updated and streamlined.
Impact H-1: Loss of Upland Habitats (LTS) **Mitigation**: No mitigation required	This effect is now covered under: **Effect BIO-3**: Potential Injury or Mortality of, and Potential Loss of Suitable Habitat for, Valley Elderberry Longhorn Beetle (LTS-M) **Mitigation Measure BIO-MM-2:** Implement Protection, Restoration, and Maintenance Measures for Valley Elderberry Longhorn Beetle. **Effect BIO-5**: Loss of Suitable Aquatic and Upland Habitat for Giant Garter Snake (LTS) **Mitigation:** No mitigation is required **Effect BIO-7**: Loss of Suitable Foraging and Nesting Habitat for Swainson's Hawk (LTS-M) **Mitigation:** No mitigation is required **Effect BIO-8**: Loss of Foraging Habitats for Migratory or Wintering Waterfowl (LTS) **Mitigation:** No mitigation is required
Impact H-2: Increase in Suitable Wetland Habitats for Nongame Water and Wading Birds (B) **Mitigation**: No mitigation required	This effect is no longer applicable based on the defined significance criteria for effects to biological resources.
Impact H-3: Loss of Foraging Habitats for Wintering Waterfowl (LTS) **Mitigation**: No mitigation required	**Effect BIO-8**: Loss of Foraging Habitats for Migratory or Wintering Waterfowl (LTS) **Mitigation**: No mitigation is required. No change.
Impact H-4: Increase in Suitable Breeding Habitats for Waterfowl (B) **Mitigation:** No mitigation is required	This effect is no longer applicable based on the defined significance criteria for effects to biological resources.
Impact H-5: Loss of Habitats for Upland Game Species (LTS) **Mitigation:** No mitigation is required	This effect is no longer applicable based on the defined significance criteria for effects to biological resources.
Impact H-6: Increase in Suitable Foraging Habitat for Greater Sandhill Crane (B) **Mitigation:** No mitigation is required	This effect is now covered under: **Effect BIO-9**: Loss of Suitable Foraging Habitat for Greater Sandhill Crane (LTS and B)

Table 3.5-11 Comparison of Delta Wetlands Project 2001 FEIS and this SEIS Effects and Mitigation Measures for Biological Resources	
2001 FEIS Effects and Mitigation Measures	SEIS Effects and Mitigation Measures
	Mitigation: No mitigation is required.
Impact H-7: Increase in Suitable Roosting Habitat for Greater Sandhill Crane (B) **Mitigation:** No mitigation is required	This effect is no longer applicable based on the defined significance criteria for effects to biological resources.
Impact H-8: Increase in Suitable Foraging Habitat for Swainson's Hawk (B) **Mitigation:** No mitigation is required	This effect is now covered under: **Effect BIO-7**: Loss of Suitable Foraging and Nesting Habitat for Swainson's Hawk (LTS) **Mitigation:** No mitigation is required
Impact H-9: Increase in Suitable Nesting Habitat for Swainson's Hawk (B) **Mitigation:** No mitigation is required	This effect is now covered under: **Effect BIO-7**: Loss of Suitable Foraging and Nesting Habitat for Swainson's Hawk (LTS) **Mitigation:** No mitigation is required
Impact H-10: Loss of Foraging Habitat for Aleutian Canada Goose (LTS) **Mitigation:** No mitigation is required	This effect is no longer applicable based on the defined significance criteria for effects to biological resources.
Impact H-11: Increase in Suitable Nesting Habitat for Northern Harrier (B) **Mitigation:** No mitigation is required	This effect is no longer applicable based on the defined significance criteria for effects to biological resources.
Impact H-12: Loss of Wintering Habitat for Tricolored Blackbird (LTS) **Mitigation:** No mitigation is required	This effect is no longer applicable based on the defined significance criteria for effects to biological resources.
Impact H-13: Increase in Suitable Nesting Habitat for Tricolored Blackbird (B) **Mitigation:** No mitigation is required	This effect is no longer applicable based on the defined significance criteria for effects to biological resources.
Impact H-14: Increase in Suitable Habitats for Special-Status Wildlife Species (B) **Mitigation**: No mitigation is required	This effect is now covered under: **Effect BIO-5**: Loss of Suitable Aquatic and Upland Habitat for Giant Garter Snake (LTS) **Mitigation:** No mitigation is required **Effect BIO-7**: Loss of Suitable Foraging and Nesting Habitat for Swainson's Hawk (LTS) **Mitigation:** No mitigation is required **Effect BIO-8**: Loss of Foraging Habitats for Migratory or Wintering Waterfowl (LTS) **Mitigation:** No mitigation is required
Impact H-15: Temporary Construction Impacts on State-Listed Species (LTS-M) **Mitigation Measure H-1:** Develop and Implement a Construction Mitigation Plan for the Reservoir Islands	This effect is now covered under: **Effect BIO-4**: Potential Injury or Mortality of Giant Garter Snake (LTS-M) **Mitigation Measure BIO-MM-3:** Implement Protection Measures for Giant Garter Snake **Effect BIO-6**: Potential Injury or Mortality of Swainson's Hawk (LTS-M) **Mitigation Measure BIO-MM-4**: Implement Protection

Table 3.5-11 Comparison of Delta Wetlands Project 2001 FEIS and this SEIS Effects and Mitigation Measures for Biological Resources	
2001 FEIS Effects and Mitigation Measures	SEIS Effects and Mitigation Measures
	Measures for Swainson's Hawk. **Effect BIO-10**: Potential Injury or Mortality of Migratory Birds (LTS-M) **Mitigation Measure BIO-MM-5:** Implement Protection Measures for Migratory Birds
Impact H-16: Disturbance to Greater Sandhill Cranes and Wintering Waterfowl from Aircraft Operations (LTS-M) **Mitigation Measure H-2:** Monitor Effects of Aircraft Flights on Greater Sandhill Cranes and Wintering Waterfowl and Implement Actions to Reduce Aircraft Disturbances of Wildlife	Runway no longer proposed, effect no longer applicable.
Impact H-17: Potential for Increased Incidence of Waterfowl Diseases (LTS-M) **Mitigation Measure H-3:** Monitor Waterfowl Populations for Incidence of Disease and Implement Actions to Reduce Waterfowl Mortality	Operational changes of reservoirs (seasonal only) avoids this effect, effect not applicable.
Impact H-18: Potential Disruption of Waterfowl Use as a Result of Increased Hunting (LTS) **Mitigation:** No mitigation is required	No change in hunting levels is now proposed, effect no longer applicable.
Impact H-19: Potential Disruption of Greater Sandhill Crane Use of the Habitat Islands as a Result of Increased Hunting (LTS) **Mitigation:** No mitigation is required	No change in hunting levels is now proposed, effect no longer applicable.
Impact H-20: Increase in Waterfowl Harvest Mortality (LTS) **Mitigation:** No mitigation is required	No change in hunting levels is now proposed, effect no longer applicable.
Impact H-21: Potential Changes in Local and Regional Waterfowl Use Patterns (LTS) **Mitigation:** No mitigation is required	This effect is no longer applicable based on the defined significance criteria for effects to biological resources.
Impact H-22: Potential Effects on Wildlife and Wildlife Habitats Resulting from Delta Outflow Changes (LTS) **Mitigation:** No mitigation is required	This effect is no longer applicable based on the defined significance criteria for effects to biological resources.
Not previously evaluated	**Effect BIO-1**: Introduction and Spread of Invasive Plants (LTS) **Mitigation**: No mitigation is required
Alternative 3	
Impact G-3: Loss of Upland and Agricultural Habitats (LTS) **Mitigation**: No mitigation required	This effect is now covered under: **Effect BIO-3**: Potential Injury or Mortality of, and Potential Loss of Suitable Habitat for, Valley Elderberry Longhorn Beetle (LTS-M) **Mitigation Measure BIO-MM-2:** Implement Protection, Restoration, and Maintenance Measures for Valley Elderberry Longhorn Beetle **Mitigation Measure BIO-MM-6**: Compensate for Loss of

Table 3.5-11
Comparison of Delta Wetlands Project 2001 FEIS and this SEIS Effects and Mitigation Measures for Biological Resources

2001 FEIS Effects and Mitigation Measures	SEIS Effects and Mitigation Measures
	Habitats for Special-Status Species and Wintering Birds through an Off-Site Wildlife Habitat Mitigation Site **Effect BIO-5**: Loss of Suitable Aquatic and Upland Habitat for Giant Garter Snake (LTS-M) **Mitigation Measure BIO-MM-3:** Implement Protection Measures for Giant Garter Snake **Mitigation Measure BIO-MM-6**: Compensate for Loss of Habitats for Special-Status Species and Wintering Birds through an Off-Site Wildlife Habitat Mitigation Site **Effect BIO-7**: Loss of Suitable Foraging and Nesting Habitat for Swainson's Hawk (LTS-M) **Mitigation Measure BIO-MM-6**: Compensate for Loss of Habitats for Special-Status Species and Wintering Birds through an Off-Site Wildlife Habitat Mitigation Site **Effect BIO-8**: Loss of Foraging Habitats for Migratory or Wintering Waterfowl (LTS-M) **Mitigation Measure BIO-MM-6**: Compensate for Loss of Habitats for Special-Status Species and Wintering Birds through an Off-Site Wildlife Habitat Mitigation Site
Impact G-6: Loss of Special-Status Plants (LTS-M) **Mitigation Measure G-1:** Site project Facilities to Avoid Special-Status Plant Populations **Mitigation Measure G-2:** Protect Special- Status Plant Populations from Construction and Recreational Activities **Mitigation Measure G-3:** Develop and Implement a Special-Status Plant Species Mitigation Plan	**Effect BIO-2:** Loss of Special-Status Plants (LTS-M) **Mitigation Measure BIO-MM-1:** Implement Pre-Construction Surveys, Avoidance, and Compensation for Project Effects to Special-Status Plants This mitigation measure has been updated and streamlined.
Impact H-23: Loss of Upland Habitats (LTS-M) **Mitigation Measure H-4**: Develop and Implement an Offsite Wildlife Habitat Mitigation Plan	This effect is now covered under: **Effect BIO-5**: Loss of Suitable Aquatic and Upland Habitat for Giant Garter Snake (LTS-M) **Mitigation Measure BIO-MM-3:** Implement Protection Measures for Giant Garter Snake **Mitigation Measure BIO-MM-6**: Compensate for Loss of Habitats for Special-Status Species and Wintering Birds through an Off-Site Wildlife Habitat Mitigation Site **Effect BIO-7**: Loss of Suitable Foraging and Nesting Habitat for Swainson's Hawk (LTS-M) **Mitigation Measure BIO-MM-6**: Compensate for Loss of Habitats for Special-Status Species and Wintering Birds through an Off-Site Wildlife Habitat Mitigation Site **Effect BIO-8**: Loss of Foraging Habitats for Wintering Waterfowl (LTS-M) **Mitigation Measure BIO-MM-6**: Compensate for Loss of Habitats for Special-Status Species and Wintering Birds through an Off-Site Wildlife Habitat Mitigation Site

Table 3.5-11
Comparison of Delta Wetlands Project 2001 FEIS and this SEIS Effects and Mitigation Measures for Biological Resources

2001 FEIS Effects and Mitigation Measures	SEIS Effects and Mitigation Measures
Impact H-24: Loss of Foraging Habitats for Wintering Waterfowl (LTS-M) **Mitigation Measure H-4**: Develop and Implement an Offsite Wildlife Habitat Mitigation Plan	**Effect BIO-8**: Loss of Foraging Habitats for Migratory or Wintering Waterfowl (LTS-M) **Mitigation Measure BIO-MM-6**: Compensate for Loss of Habitats for Special-Status Species and Wintering Birds through an Off-Site Wildlife Habitat Mitigation Site
Impact H-25: Increase in Suitable Breeding Habitats for Waterfowl (B) **Mitigation:** No mitigation is required	This effect is no longer applicable based on the defined significance criteria for effects to biological resources
Impact H-26: Loss of Habitats for Upland Game Species (LTS-M) **Mitigation Measure H-4**: Develop and Implement an Off-Site Wildlife Habitat Mitigation Plan	This effect is no longer applicable based on the defined significance criteria for effects to biological resources.
Impact H-27: Loss of Suitable Foraging Habitat for Greater Sandhill Crane (LTS-M) **Mitigation Measure H-4**: Develop and Implement an Offsite Wildlife Habitat Mitigation Plan	**Effect BIO-9**: Loss of Suitable Foraging Habitat for Greater Sandhill Crane (LTS-M) **Mitigation Measure BIO-MM-6**: Compensate for Loss of Habitats for Special-Status Species and Wintering Birds through an Off-Site Wildlife Habitat Mitigation Site
Impact H-28: Loss of Foraging Habitat for Swainson's Hawk (LTS-M) **Mitigation Measure H-4**: Develop and Implement an Offsite Wildlife Habitat Mitigation Plan	**Effect BIO-7**: Loss of Suitable Foraging and Nesting Habitat for Swainson's Hawk (LTS-M) **Mitigation Measure BIO-MM-6**: Compensate for Loss of Habitats for Special-Status Species and Wintering Birds through an Off-Site Wildlife Habitat Mitigation Site
Impact H-29: Loss of Foraging Habitat for Aleutian Canada Goose (LTS) **Mitigation:** No mitigation is required	This effect is no longer applicable based on the defined significance criteria for effects to biological resources.
Impact H-30: Loss of Suitable Nesting Habitat for Northern Harrier (LTS-M) **Mitigation Measure H-4**: Develop and Implement an Offsite Wildlife Habitat Mitigation Plan	This effect is no longer applicable based on the defined significance criteria for effects to biological resources.
Impact H-31: Loss of Wintering Habitat for Tricolored Blackbird (LTS) **Mitigation:** No mitigation is required	This effect is no longer applicable based on the defined significance criteria for effects to biological resources.
Impact H-32: Temporary Construction Impacts on State-Listed Species (LTS-M) **Mitigation Measure H-1:** Develop and Implement a Construction Mitigation Plan for the Reservoir Islands	This effect is now covered under: **Effect BIO-4**: Potential Injury or Mortality of Giant Garter Snake (LTS-M) **Mitigation Measure BIO-MM-3:** Implement Protection Measures for Giant Garter Snake **Effect BIO-6**: Potential Injury or Mortality of Swainson's Hawk (LTS-M) **Mitigation Measure BIO-MM-4**: Implement Protection Measures for Swainson's Hawk **Effect BIO-10**: Potential Injury or Mortality of Migratory Birds (LTS-M) **Mitigation Measure BIO-MM-5:** Implement Protection

Table 3.5-11 Comparison of Delta Wetlands Project 2001 FEIS and this SEIS Effects and Mitigation Measures for Biological Resources	
2001 FEIS Effects and Mitigation Measures	SEIS Effects and Mitigation Measures
	Measures for Migratory Birds
Impact H-33: Potential for Increased Incidence of Waterfowl Diseases (LTS-M) **Mitigation Measure H-3:** Monitor Waterfowl Populations for Incidence of Disease and Implement Actions to Reduce Waterfowl Mortality	This effect is no longer applicable based on the defined significance criteria for effects to biological resources.
Impact H-34: Potential Disruption of Waterfowl Use as a Result of Increased Hunting (LTS) **Mitigation:** No mitigation is required	This effect is no longer applicable based on the defined significance criteria for effects to biological resources.
Impact H-35: Increase in Waterfowl Harvest Mortality (LTS) **Mitigation:** No mitigation is required	No change in hunting levels is proposed, effect no longer applicable.
Impact H-36: Potential Changes in Local and Regional Waterfowl Use Patterns (LTS) **Mitigation:** No mitigation is required	This effect is no longer applicable based on the defined significance criteria for effects to biological resources.
Impact H-37: Potential Effects on Wildlife and Wildlife Habitats Resulting from Delta Outflow Changes (LTS) **Mitigation:** No mitigation is required	This effect is no longer applicable based on the defined significance criteria for effects to biological resources.
Not previously evaluated	**Effect BIO-1**: Introduction and Spread of Invasive Plants (LTS) **Mitigation**: No mitigation is required.
Not previously evaluated	**Effect BIO-11:** Habitat Conversion and Potential Effects on Associated Special-Status Species from Off-Site Mitigation (LTS-M) **Mitigation Measure BIO-MM-7:** Conduct Detailed Effects Assessment for Off-Site Mitigation Sites, Quantify Effects, and Include Necessary Mitigation in the Off-Site Compensatory Mitigation Plan

Notes: Shading denotes changes in the effect, significance conclusion, or mitigation measure from the 2001 FEIS; LTS = Less than significant; LTS-M = Less than significant with mitigation; B = Beneficial

Sources: ICF 2010:4.6-3, 4.6-4, and 4.7-2 through 4.7-7 and AECOM 2013

3.5.6 SECONDARY AND CUMULATIVE EFFECTS

Secondary and cumulative effects on biological resources resulting from implementing the project were described in the 2001 FEIS (Chapters 3G and 3H) and 2010 DEIR (Chapter 5). The 2001 FEIS and 2010 DEIR are herein incorporated by reference. The secondary and cumulative effects conclusions and mitigation measures are discussed below and are shown in Table 3.5-12.

CUMULATIVE BIOLOGICAL RESOURCE CHANGES IN THE DELTA

The Delta has experienced pronounced changes over the past 150 years, primarily associated with resource extraction (i.e., Placer mining), agricultural development, development of water supplies, and flood protection

(Whipple et al. 2012). The result of these changes has led to a highly managed aquatic and terrestrial system, with salinity levels, water quality, levee integrity, fish and wildlife populations, and many other variables targeted by specific management objectives. For terrestrial species, the conversion of the majority of Delta islands to agricultural uses has resulted in a reduction in suitable habitat for many wetland-dependent species, while providing new opportunities for other species. For example, many waterfowl benefit from the flooding of agricultural lands in the winter, while Swainson's hawks and other raptors may forage farm fields in the summer. Nevertheless, with ongoing subsidence of Delta islands, these terrestrial habitats are at constant risk of flooding and their long-term sustainability requires a continued investment in perimeter levees.

Ongoing and planned future activities in the Delta include the continuation of agricultural activities as well as infrastructure improvements. These projects often include levee construction and repair, channel dredging, channel bank rip-rap installation, island drainages, reclamation for agriculture, and infrastructure construction on the islands (e.g., roads, bridges, pump stations, drainage ditches, residences and equipment buildings). Many of these associated activities cause a reduction in acreage or change in characteristics of vegetation communities and wildlife habitats. These circumstances have led to development of several plans, policies, and regulations that are intended to conserve and enhance the quality and distribution of sensitive habitats in the Delta.

While most of the focus on Delta conservation efforts is on aquatic systems, many terrestrial species and habitats are also targeted. Restoration projects such as Spring Branch Creek at Rush Ranch, Dutch Slough, the Kerry Property on Liberty Island, and the Montezuma Wetlands Project, aim to restore both wetland and upland habitats. Compensatory mitigation sites such as Chipps Island East and Wheeler Island are largely focused on compensation for wetland and aquatic habitats. The Bay Delta Conservation Plan (BDCP) is proposing large-scale changes in the Delta region, including the creation/enhancement of approximately 100,000 acres of wetland and upland habitats as mitigation for state and Federal water projects aimed at improving the reliability of California's water supply. The approach of BDCP is driven by a focus on ecological function and multi-species benefits rather than the species-by-species approach to compensation that has been used in the past. A multitude of state and Federal water projects would be covered under the BDCP; each project would be included in the streamlined permitting process and comprehensive Delta-wide restoration program. However, BDCP is still in the Draft EIR/EIS stage, and has substantial technical, legal, political, and financing hurdles to overcome prior to implementation. Therefore, its full implementation is speculative at present. Furthermore, if approved, the creation of habitat would take place over a 50-year time period.

Cumulative Loss in Foraging Habitat for Wintering Waterfowl in the Delta

This cumulative effect has not changed since the 2001 FEIS was prepared. Foraging habitat for wintering waterfowl would increase in the Delta as mitigation projects that convert existing land uses to habitat uses (including the Habitat Islands as part of this project) are implemented. Additionally, continued use of agricultural lands would maintain existing winter forage habitat. Therefore, the project would not result in a cumulatively considerable contribution to loss in foraging habitat for wintering waterfowl in the Delta.

Cumulative Loss of Suitable Habitat for Valley Elderberry Longhorn Beetle in the Delta

The cumulative loss of elderberry plants within the range of VELB is uncertain, according to the USFWS (U.S. Fish and Wildlife Service 2005). Although there continues to be a loss of remnant natural areas (specifically riparian and grassland ecosystems), mitigation for loss of individual plants appears, at least superficially, to more than compensate for the number of plants lost. The maintenance of replacement plantings, and the use of those mitigation areas by VELB, however, are also uncertain. Therefore, there is not a measurable cumulative loss of suitable VELB habitat within a regional context. However, the project would result in a loss of suitable habitat for VELB, and that loss is considered cumulatively considerable.

Mitigation Measure: Implement Mitigation Measure BIO-MM-2 (Implement Protection, Restoration, and Maintenance Measures for Valley Elderberry Longhorn Beetle).

Mitigation Measure: Implement Mitigation Measure BIO-MM-6 (Compensate for Loss of Habitats for Special-Status Species and Migratory and Wintering Birds through an Off-Site Compensatory Mitigation Site).

Implementing Mitigation Measure BIO-MM-2 under Alternatives 1 and 2 and implementing Mitigation Measures BIO-MM-2 and BIO-MM-6 under Alternative 3 would reduce the project's contribution to a level that is less-than-cumulatively considerable because measures would be implemented to avoid and protect the species and its habitat and because compensatory VELB habitat would be provided.

Cumulative Loss of Suitable Aquatic and Upland Habitat for Giant Garter Snake in the Delta

Giant garter snake was listed as threatened by USFWS in October 1993. Since that time, its abundance and distribution have not substantially changed (U.S. Fish and Wildlife Service 2006), although giant garter snake continues to be threatened by habitat destruction and fragmentation within its range. Under Alternatives 1 and 2, enhancement and creation of suitable giant garter snake habitat described in the Draft CMP would provide four times the acreage of existing aquatic habitat and one and a half times the acreage of existing upland habitat. Therefore, implementation of Alternatives 1 and 2 would not result in a cumulatively considerable contribution to the loss of aquatic and upland habitat for giant garter snake in the Delta.

Mitigation Measure: No mitigation is required.

However, under Alternative 3, all four project islands would be used for reservoir storage. The loss of aquatic and upland habitat for giant garter snake under Alternative 3 would represent a cumulatively considerable effect.

Mitigation Measure: Implement Mitigation Measure BIO-MM-3 (Implement Protection Measures for Giant Garter Snake).

Mitigation Measure: Implement Mitigation Measure BIO-MM-6 (Compensate for Loss of Habitats for Special-Status Species and Migratory and Wintering Birds through an Off-Site Compensatory Mitigation Site).

Implementing Mitigation Measures BIO-MM-3 and BIO-MM-6 would reduce the project's contribution to loss of suitable aquatic and upland habitat for giant garter snake to a level that is less-than-cumulatively considerable because measures would be implemented to avoid and protect the species and its habitat, and to compensate for overall loss of habitat as a result of project implementation.

Cumulative Loss of Suitable Foraging and Nesting Habitat for Swainson's Hawk in the Delta

The primary reasons for decline of Swainson's hawk throughout its range are the loss of nesting habitat in riparian areas and the loss of foraging habitat. Suitable foraging habitat is lost through conversion of agricultural land to urban and other uses and the use of incompatible crops on existing agricultural land (California Department of Fish and Game 1994). The Delta Wetlands project, along with other restoration projects and mitigation in the Delta region, would continue to compensate for losses to nesting and foraging habitat and are expected to cumulatively increase the quality and permanence (under conservation easements) of Swainson's hawk habitat as these areas are managed with the goal of maintaining suitable habitat. Additionally, implementation of the Draft CMP under Alternatives 1 and 2 ensures that agricultural production is preserved on the Habitat islands and that agricultural crops grown there are compatible with Swainson's hawk foraging requirements. Therefore, Alternatives 1 and 2 would not result in a cumulatively considerable contribution to this effect.

Mitigation Measure: No mitigation is required.

However, under Alternative 3, approximately 17,684 acres of foraging habitat for Swainson's hawk and approximately 210 acres of suitable nesting habitat for Swainson's hawk would be lost. The NBHA would allow for the conservation and protection of some foraging and nesting habitat for this species. However, loss of this large quantity of habitat is considered cumulatively considerable.

Mitigation Measure: Implement Mitigation Measure BIO-MM-6 (Compensate for Loss of Habitats for Special-Status Species and Migratory and Wintering Birds through an Off-Site Compensatory Mitigation Site).

Implementing Mitigation Measure BIO-MM-6 would reduce the project's contribution to a level that is less-than-cumulatively considerable because the project would develop and implement an off-site compensatory mitigation site.

Cumulative Loss of Special-Status Plant Populations in the Delta

Special-status plant surveys were conducted on all project islands in 1988, 1994, and 2002. Together, over 100 populations of Mason's lilaeopsis were observed, but no other state- or Federally listed plants were observed. The populations of Mason's lilaeopsis are located on the exterior levee slopes and on in-channel islands adjacent to the project area where they are unlikely to be affected by reservoir construction or new facilities on the Reservoir Islands, or by habitat creation and enhancement on the Habitat Islands. While several other special-status plants occur in the Delta region (e.g., Contra Costa wallflower, Delta button-celery, Bogg's Lake hedge-hyssop, and Antioch Dunes evening-primrose), survey results were negative for these species and most are unlikely to occur at the project site due to a lack of suitable habitat. Therefore, based on survey data obtained over multiple decades, existing populations of Mason's lilaeopsis are fairly well identified and can either be avoided by project construction or occur outside of the disturbance area. However, additional plants may have become established since the surveys were performed, and therefore the project's effect on special-status plants could be cumulatively considerable.

Mitigation Measure: Implement Mitigation Measure BIO-MM-1 (Implement Pre-Construction Surveys, Avoidance, and Compensation for Project Effects to Special-Status Plants).

Implementation of Mitigation Measure BIO-MM-1 would reduce the project's contribution to a level that is less-than-cumulatively considerable because surveys would be conducted prior to construction to identify and protect (i.e., avoid) any potential special-status plants. If plants are found and cannot be avoided, a plan would be prepared and implemented to compensate for any loss.

Table 3.5-12
Comparison of Secondary and Cumulative Biological Resources Effects between the 2001 FEIS and this SEIS

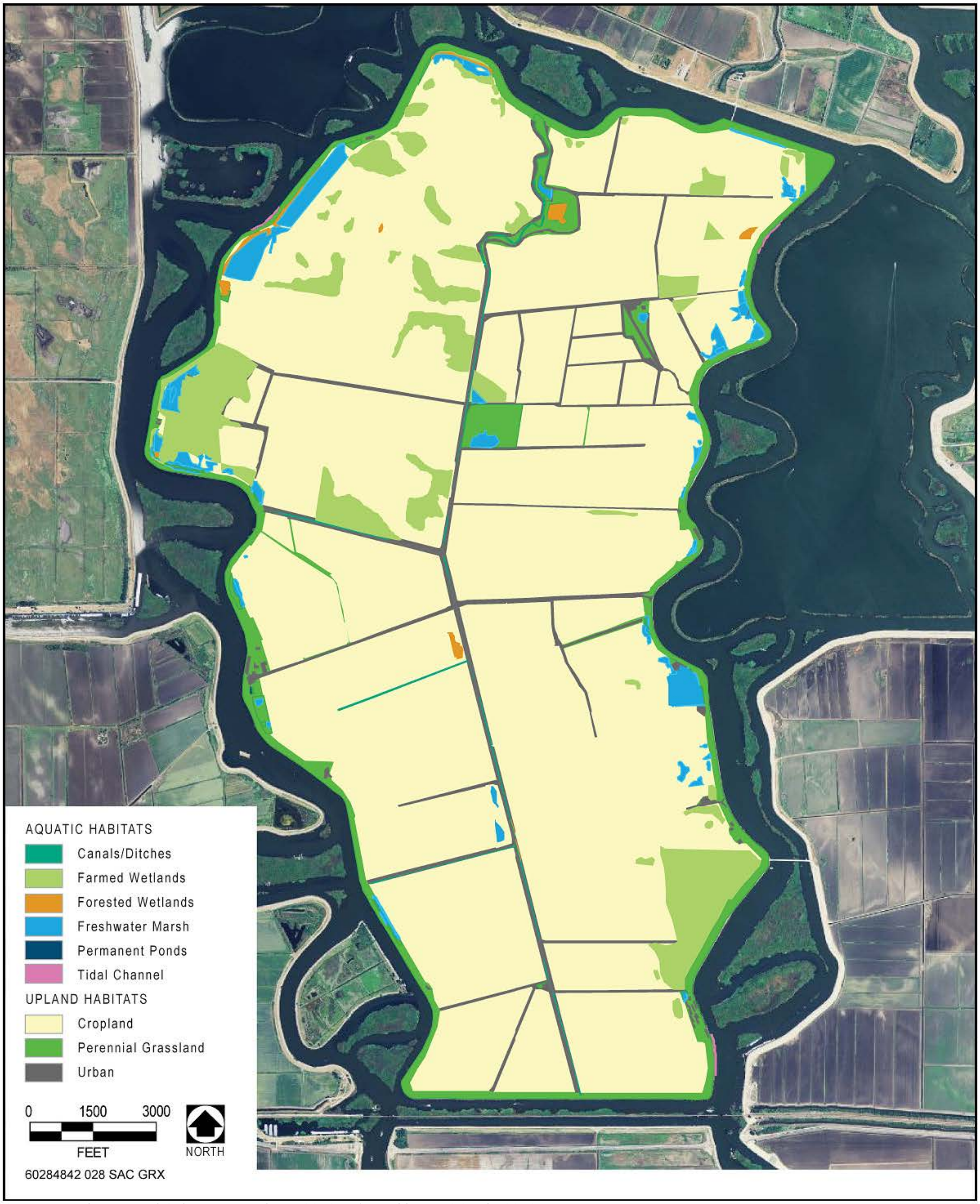
2001 FEIS Cumulative Effects and Mitigation Measures	SEIS Cumulative Effects and Mitigation Measures
Impact H-38: Cumulative Increase in Foraging Habitat for Wintering Waterfowl in the Delta (B) **Mitigation**: No mitigation is necessary	Cumulative Loss of Foraging Habitat for Wintering Waterfowl in the Delta (NCC) **Mitigation**: No mitigation is required.
Impact H-39: Cumulative Loss of Herbaceous Habitats in the Delta (NCC) **Mitigation**: No mitigation is necessary	This effect is now covered under: Cumulative Loss of Suitable Habitat for Valley Elderberry Longhorn Beetle (NCC-M) **Mitigation Measure BIO-MM-2:** Implement Protection, Restoration, and Maintenance Measures for Valley Elderberry Longhorn Beetle **Mitigation Measure BIO-MM-6:** Compensate for Loss of Habitats for Special-Status Species and Migratory and Wintering Birds through an Off-Site Compensatory Mitigation Site Cumulative Loss of Suitable Aquatic and Upland Habitat for

Table 3.5-12
Comparison of Secondary and Cumulative Biological Resources Effects between the 2001 FEIS and this SEIS

2001 FEIS Cumulative Effects and Mitigation Measures	SEIS Cumulative Effects and Mitigation Measures
	Giant Garter Snake (Alternatives 1 and 2, NCC; Alternative 3, NCC-M) **Mitigation Measure BIO-MM-3:** Implement Protection Measures for Giant Garter Snake **Mitigation Measure BIO-MM-6:** Compensate for Loss of Habitats for Special-Status Species and Migratory and Wintering Birds through an Off-Site Compensatory Mitigation Site Cumulative Loss of Suitable Foraging and Nesting Habitat for Swainson's Hawk (Alternatives 1 and 2, NCC; Alternative 3, NCC-M) **Mitigation Measure BIO-MM-6:** Compensate for Loss of Habitats for Special-Status Species and Migratory and Wintering Birds through an Off-Site Compensatory Mitigation Site
Not previously evaluated	Cumulative Loss of Special-Status Plant Populations in the Delta (NCC-M) **Mitigation Measure BIO-MM-1:** Implement Pre-Construction Surveys, Avoidance, and Compensation for Project Effects to Special-Status Plants

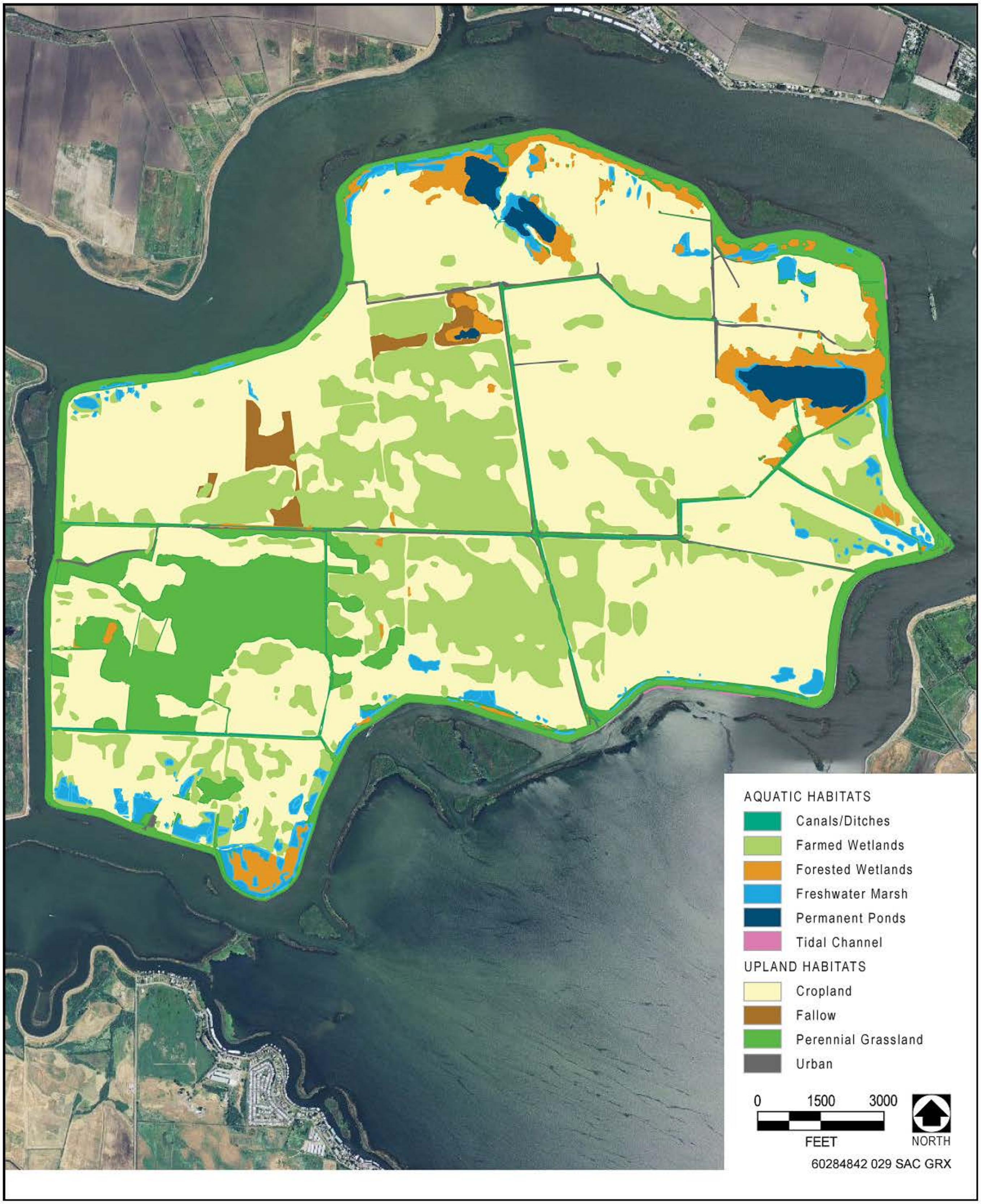
Notes: Shading denotes changes in the effect, significance conclusion, or mitigation measure from the 2001 FEIS; NCC = Not cumulatively considerable; NCC-M = Not cumulatively considerable with mitigation; B = Beneficial

Source: AECOM 2014



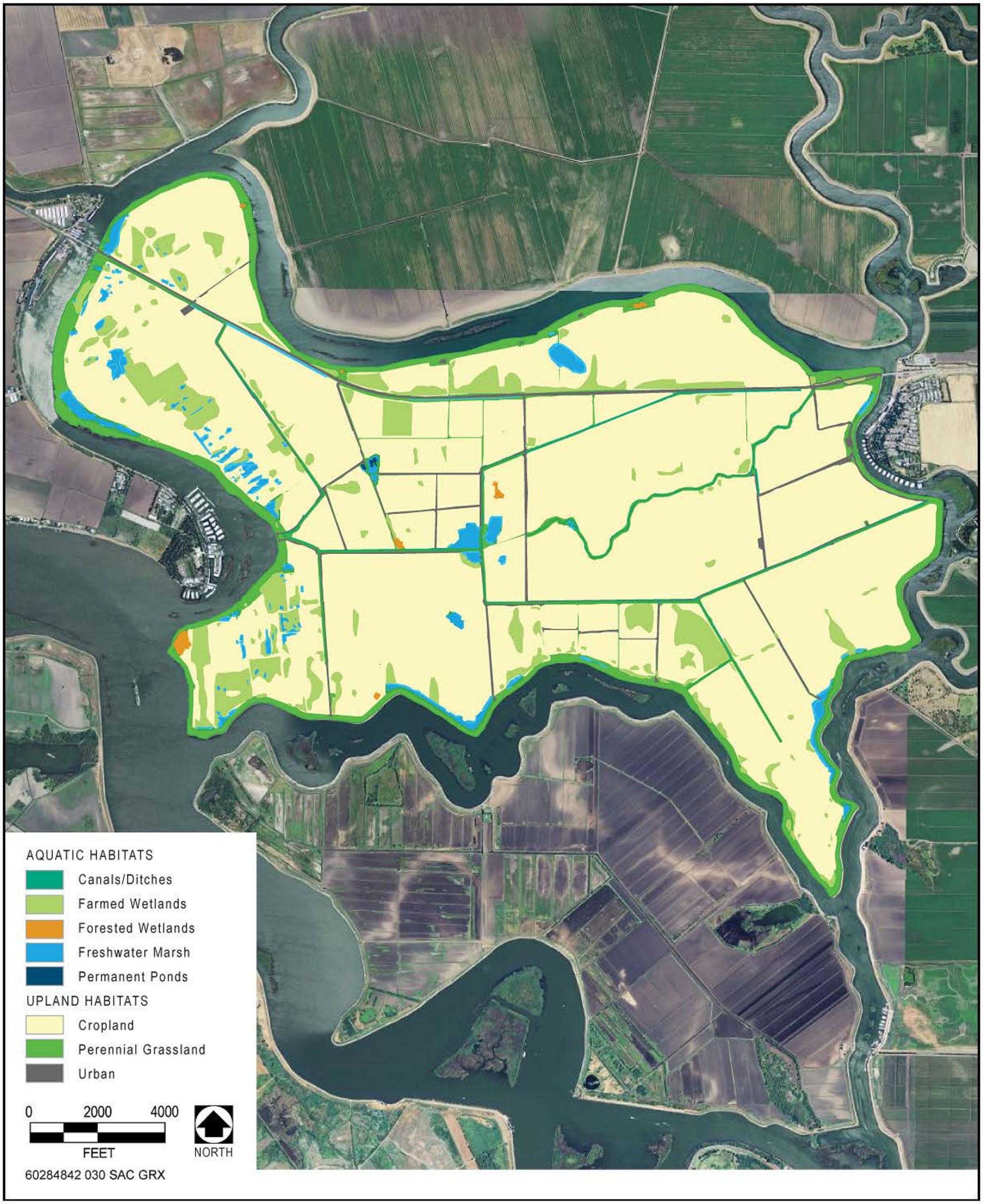
Source: Environmental Science Associates 2013, adapted by AECOM in 2013

Exhibit 3.5-1 **Bacon Island Habitats**



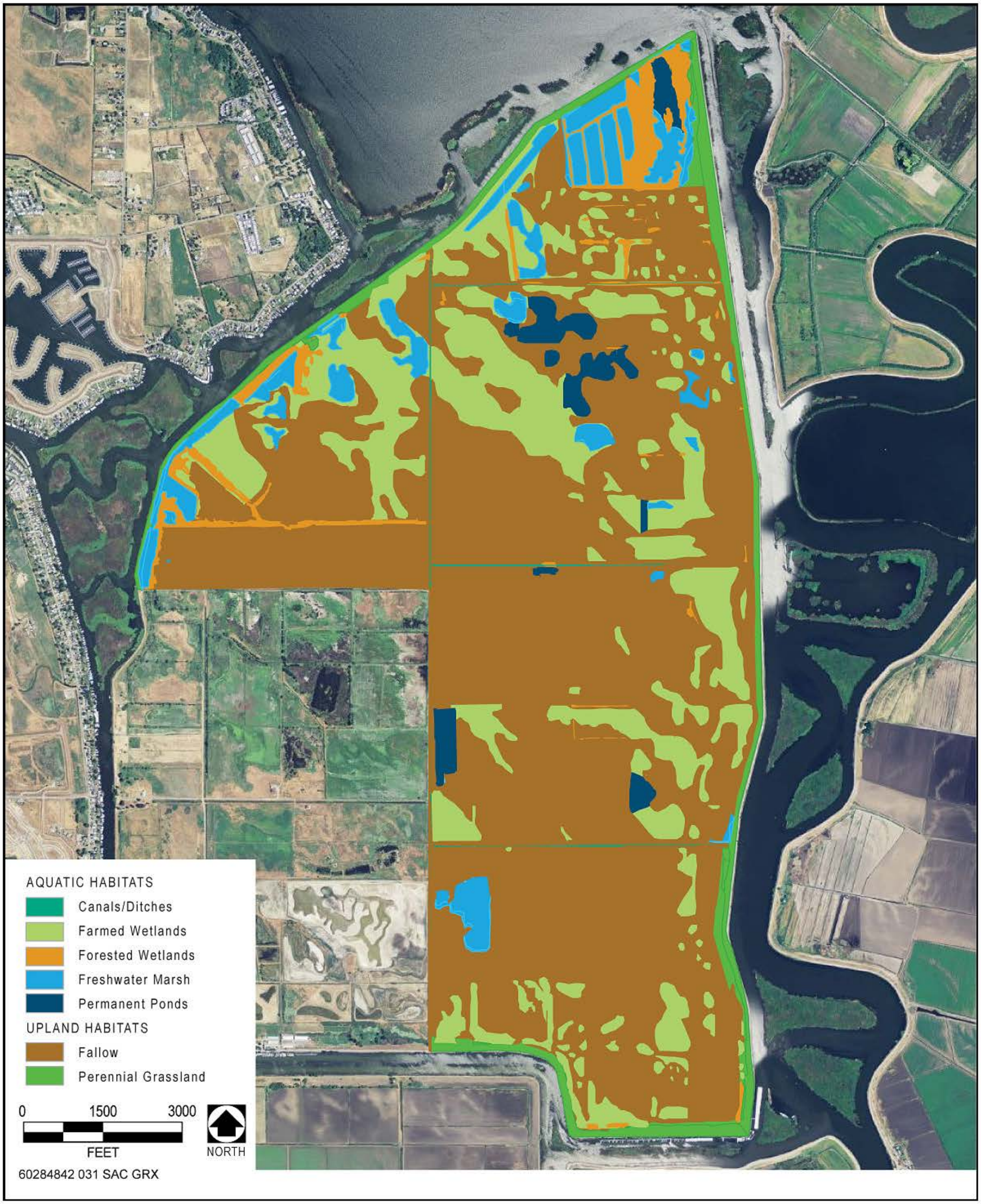
Source: Environmental Science Associates 2013, adapted by AECOM in 2013

Exhibit 3.5-2 **Webb Tract Habitats**



Source: Environmental Science Associates 2013, adapted by AECOM in 2013

Exhibit 3.5-3 **Bouldin Island Habitats**



Source: Environmental Science Associates 2013, adapted by AECOM in 2013

Exhibit 3.5-4 **Holland Tract Habitats**

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3.6 CLIMATE CHANGE

3.6.1 INTRODUCTION

This section describes the existing environmental conditions and regulatory setting of the project area, summarizes the affected environment, and describes environmental effects of the project regarding climate change. The effects of global climate change were not discussed in the 2001 FEIS. They were, however, discussed in the 2010 DEIR (Section 4.14), which is herein incorporated by reference. Because the effects related to climate change are inherently cumulative in nature, this section does not include a separate cumulative effects analysis. Although an analysis of the potential effects of the environment on the project is not required, the project includes strengthening of the existing levees around all four islands, which would help to protect against future potential effects of climate change such as sea level rise and flooding. See Section 3.9, “Floodplain Management,” for further discussion.

3.6.2 AFFECTED ENVIRONMENT

INTRODUCTION TO CLIMATE CHANGE

The average surface temperature of the Earth has risen by about 1 degree Fahrenheit (°F) in the past century, with most of that rise occurring during the past two decades (World Meteorological Organization 2005). Correspondingly, the probable increases in average temperatures between 3 and 8°F (Cayan et al. 2006) may appear noticeable, but still insignificant. In July, the average high temperature in the region is 94°F. This number is created by averaging temperatures over decades, not just for one particular year. Although the average is 94°F, the individual days and weeks making up that average are as much as 20°F warmer or cooler in the extreme cases and up to 10°F warmer or cooler on a more regular basis. Therefore, applying an average increase of 8°F in a strictly linear way (omitting forcing effects) would mean that the average July temperature in the region would be 102°F, and that temperatures could get as hot as 122°F in an extreme event (the current record is 114°F) and could regularly reach 112°F.

The principal greenhouse gases (GHGs) that enter the atmosphere because of human activities are carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and fluorinated gases. From 1750 to 2004, concentrations of CO_2, CH_4, and N_2O have increased globally by 35%, 143%, and 18%, respectively. Other GHGs, such as fluorinated gases, are created and emitted solely through human activities (U.S. Environmental Protection Agency 2008). CO_2 is referenced most frequently when discussing climate change because it is the most commonly emitted gas. However, some less commonly emitted GHGs have a greater climate-forcing effect per molecule.
Global warming potential (GWP) is a measure of how much a given mass of GHG is estimated to contribute to global warming. It is a relative scale that compares the gas in question to that of the same mass of CO_2 (whose GWP is by definition 1). In this analysis, CH_4 is assumed to have a GWP of 21 and N_2O has a GWP of 310 (California Climate Action Registry 2009). Consequently, using each pollutant’s GWP, emissions of CO_2, CH_4, and N_2O can be converted into CO_2 equivalence, also denoted as CO_2e.

GREENHOUSE GAS POLLUTANTS

Carbon Dioxide

CO_2 emissions are associated mainly with combustion of carbon-bearing fossil fuels such as gasoline, diesel, and natural gas used in mobile sources and energy generation–related activities. The U.S. Environmental Protection Agency (EPA) estimates that CO_2 emissions accounted for 84.6% of GHG emissions in the United States in 2004 (U.S. Environmental Protection Agency 2008). The California Energy Commission (CEC) estimates that CO_2 emissions account for 84% of California’s anthropogenic (human-made) GHG emissions, nearly all of which is associated with fossil fuel combustion (California Energy Commission 2005). Total CO_2 emissions in the United States increased by 20% from 1990 to 2004 (U.S. Environmental Protection Agency 2008).

Methane

Methane has both natural and anthropogenic sources. The major sources of methane are landfills, natural gas distribution systems, agricultural activities, fireplaces and wood stoves, stationary and mobile fuel combustion, and gas and oil production fields (U.S. Environmental Protection Agency 2008). The EPA estimates that CH_4 emissions accounted for 7.9% of total GHG emissions in the United States in 2004 (U.S. Environmental Protection Agency 2008). The CEC estimates that CH_4 emissions from various sources represent 6.2% of California's total GHG emissions (California Energy Commission 2005). Total CH_4 emissions in the United States decreased by 10% from 1990 to 2004 (U.S. Environmental Protection Agency 2008).

Nitrous Oxide

Nitrous oxide is produced by microbial processes in soil and water, including those reactions that occur in fertilizers that contain nitrogen. The global concentration of N_2O in 1998 was 314 parts per billion (ppb), and in addition to agricultural sources for the gas, some industrial processes (fossil fuel–fired power plants, nylon production, nitric acid production, and vehicle emissions) contribute to its atmospheric load (U.S. Environmental Protection Agency 2008).

The EPA estimates that N_2O emissions accounted for 5.5% of total GHG emissions in the United States in 2004 (U.S. Environmental Protection Agency 2008). The CEC estimates that nitrous oxide emissions from various sources represent 6.6% of California's total GHG emissions (California Energy Commission 2005). Total N_2O emissions in the United States decreased by 2% from 1990 to 2004 (U.S. Environmental Protection Agency 2008).

Fluorinated Gases

Fluorinated gases, such as hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6), are GHGs that are emitted from a variety of industrial processes. The primary sources of fluorinated gas emissions in the United States consists of HCFC-22 production, electrical transmission and distribution systems, semiconductor manufacturing, aluminum production, and magnesium production and processing. The EPA estimates that fluorinated gas (HFC, PFC, and SF_6) emissions accounted for 2.0% of total GHG emissions in the United States in 2004 (U.S. Environmental Protection Agency 2008). The CEC estimates that fluorinated gas emissions from various sources represent 3.4% of California's total GHG emissions (California Energy Commission 2005). Total fluorinated gas emissions in the United States increased by 58% from 1990 to 2004 (U.S. Environmental Protection Agency 2008).

3.6.3 REGULATORY FRAMEWORK/APPLICABLE LAWS, REGULATIONS, PLANS, AND POLICIES

Federal applicable laws and regulations are provided because they are required under NEPA. State applicable laws and regulations are provided for informational purposes and to assist with NEPA review. USACE has considered applicable state, regional, and local plans and ordinances as a part of the environmental review process for this SEIS, where applicable.

FEDERAL

Supreme Court Ruling on California Clean Air Act Waiver

The EPA is the Federal agency responsible for implementing the Federal Clean Air Act (CAA). The U.S. Supreme Court ruled on April 2, 2007 that CO_2 is an air pollutant as defined under the CAA, and that EPA has the authority to regulate emissions of GHGs. However, there are no Federal regulations or policies regarding GHG emissions applicable to the project. See Assembly Bill (AB) 1493 for further information on the California Clean Air Act (CCAA) Waiver.

Energy and Independence Security Act of 2007 and Corporate Average Fuel Economy Standards

The Energy and Independence Security Act of 2007 (EISA) amended the Energy Policy and Conservation Act (EPCA) to further reduce fuel consumption and expand production of renewable fuels. The EISA's most important amendment includes a statutory mandate for the National Highway Traffic Safety Administration (NHTSA) to set passenger car corporate average fuel economy (CAFE) standards for each model year (MY) at the maximum feasible level. This statutory mandate also eliminates the old default CAFE standard of 27.5 miles per gallon (mpg). The EISA requires that CAFE standards for MY 2011-2020 be set sufficiently high to achieve the goal of an industry-wide passenger car and light-duty truck average CAFE standard of 35 mpg. The rule making for this goal, per President Obama's request, has been divided into two separate parts. The first part, which was published in the Federal Register in March 2009, includes CAFE standards for MY 2011 to meet the statutory deadline (i.e., March 30, 2009). The second part of the rulemaking applies to MY 2012 and subsequent years. These would be the maximum CAFE standards feasible under the limits of the EPCA and EISA. The NHTSA and the EPA are currently working in coordination to develop a national program targeting MY 2012–2016 passenger cars and light trucks.

U.S. Environmental Protection Agency Proposed Regulations

In response to the mounting issue of climate change, EPA has taken the following actions to regulate, monitor, and potentially reduce GHG emissions.

Proposed Mandatory Greenhouse Gas Reporting Rule

On September 22, 2009, EPA issued a final rule for mandatory reporting of GHGs from large GHG emissions sources in the United States. In general, this national reporting requirement will provide EPA with accurate and timely GHG emissions data from facilities that emit 25,000 metric tons (MT) or more of CO_2 per year. This publically available data will allow the reporters to track their own emissions, compare them to similar facilities, and aid in identifying cost-effective opportunities to reduce emissions in the future. Reporting is at the facility level, except that certain suppliers of fossil fuels and industrial GHG emitters, along with vehicle and engine manufacturers, will report at the corporate level. An estimated 85% of the total U.S. GHG emissions, from approximately 10,000 facilities, are covered by this final rule.

National Program to Cut Greenhouse Gas Emissions and Improve Fuel Economy for Cars and Trucks

On September 15, 2009, EPA and the U.S. Department of Transportation's NHTSA proposed a new national program that would reduce GHG emissions and improve fuel economy for all new cars and trucks sold in the United States. EPA proposed the first-ever national GHG emissions standards under the CAA, and NHTSA proposed Corporate Average Fuel Economy standards under the Energy Policy and Conservation Act. This proposed national program would allow automobile manufacturers to build a single light-duty national fleet that satisfies all requirements under both Federal programs and the standards of California and other states.

Proposed Endangerment and Cause or Contribute Findings for Greenhouse Gases under the Federal Clean Air Act

On December 7, 2009, EPA adopted its *Proposed Endangerment and Cause or Contribute Findings for Greenhouse Gases* under the CAA (Endangerment Finding). The Endangerment Finding is based on Section 202(a) of the CAA, which states that the EPA Administrator should regulate and develop standards for "emission[s] of air pollution from any class or classes of new motor vehicles or new motor vehicle engines, which in [its] judgment cause, or contribute to, air pollution which may reasonably be anticipated to endanger public health or welfare." The rule addresses Section 202(a) in two distinct findings. The first addresses whether or not the concentrations of the six key GHGs (i.e., CO_2, CH_4, N_2O, HFCs, perfluorocarbons, and SF_6) in the atmosphere threaten the health and welfare of current and future generations. The second addresses whether or not the combined emissions of GHGs from new motor vehicles and motor vehicle engines contribute to atmospheric concentrations of GHGs and thus to the threat of climate change.

The EPA Administrator found that atmospheric concentrations of GHGs endanger public health and welfare within the meaning of Section 202(a) of the CAA. The EPA Administrator also found that GHG emissions from new motor vehicles and motor vehicle engines are contributing to air pollution, which is endangering public health and welfare.

STATE

Because there are few Federal regulations, laws, plans, or policies related to climate change, the primary regulatory authority applies to this project at the state level. Therefore, a discussion of state regulations, laws, plans, and policies related to climate change that are applicable to the Delta Wetlands project are presented below.

Executive Order S-3-05

Executive Order S-3-05 was signed by California Governor Schwarzenegger in June 2005. This Executive Order was important because of its clear declarative statements that climate change poses a threat to the state of California. The Executive Order states that California is "particularly vulnerable" to the effects of climate change and that climate change has the potential to reduce Sierra Nevada snowpack (a primary source of drinking water), exacerbate existing air quality problems, adversely affect human health, threaten coastal real estate and habitat by causing sea level rise, and affect crop production. The Executive Order also states that "mitigation efforts will be necessary to reduce GHG emissions."

To address the issues described above, the Executive Order established emission reduction targets for the state: reduce GHG emissions to 2000 levels by 2010, to 1990 levels by 2020, and to 80% below 1990 levels by 2050. The Secretary of the California EPA was named as coordinator for this effort, and the Executive Order required a progress report by January 2006 and biannually thereafter. As a result, the California EPA created a Climate Action Team. The Climate Action Team released the first report, which proposed to meet the emissions targets through voluntary compliance and state incentive and regulatory programs, in March 2006.

Assembly Bill 32

In September 2006, Assembly Bill (AB) 32 was signed by California Governor Schwarzenegger. AB 32 requires that California GHG emissions be reduced to 1990 levels by the year 2020, just like Executive Order S-3-05. However, AB32 is a comprehensive bill that requires the California Air Resources Board (ARB) to adopt regulations requiring the reporting and verification of statewide GHG emissions, and it establishes a schedule of action measures. AB 32 also requires that a list of emission-reduction strategies be published to achieve emissions reduction goals. AB 32 requires reductions in California's GHG emissions to 1990 levels by 2020, a roughly 25% reduction under business-as-usual estimates.

Senate Bill 97

Senate Bill (SB) 97, signed in August 2007, acknowledges that climate change is an important environmental issue that requires analysis under CEQA. The bill directed the California Office of Planning and Research (OPR) to prepare, develop, and transmit to the Resources Agency guidelines for the feasible mitigation of GHG emissions or the effects of GHG emissions, by July 1, 2009. The Natural Resources Agency proposed revisions to the text of the proposed State CEQA Guidelines amendments after a 55-day public comment period and delivered its rulemaking package to the Office of Administrative Law for their review on December 31, 2009. The Office of Administrative Law approved the amendments, and filed them with the Secretary of State for inclusion in the California Code of Regulations on February 16, 2010, and the amendments became effective on March 18, 2010.

Actions Taken by the California Office of Planning and Research

In June 2008, the OPR issued a technical advisory on CEQA and climate change (California Office of Planning and Research 2008). This document recommends that, for projects subject to CEQA, emissions be calculated and mitigation measures be identified to reduce those emissions. The OPR report does not identify emission thresholds for GHGs but instead recommends that each lead agency develop its own thresholds.

Actions Taken by California Attorney General's Office

The California Attorney General (AG) has prepared a report that lists measures that local agencies should consider under CEQA to offset or reduce global warming effects. The AG's office also has prepared a chart of modeling tools to estimate GHG emissions effects of projects and plans. Information on the AG's actions can be found on the California Department of Justice Office of Attorney General website (California Department of Justice 2009).

California Air Pollution Control Officers Association Guidance

The California Air Pollution Control Officers Association (CAPCOA) released a report in January 2008 that describes methods to estimate and mitigate GHG emissions from projects subject to CEQA. The CAPCOA report evaluates several GHG thresholds that could be used to evaluate the significance of a project's GHG emissions. The CAPCOA report, however, does not recommend any single threshold. Instead, the report is designed as a resource for public agencies as they establish agency procedures for reviewing GHG emissions from projects subject to CEQA (California Air Pollution Control Officers Association 2008).

3.6.4 Assessment Methodology

The approach used to evaluate GHG effects involved estimating GHG emissions for construction and existing conditions, and then comparing the estimated GHG emissions under each alternative to existing conditions. Because Alternative 1 and Alternative 2 would be substantially the same in terms of construction and operation, their GHG emissions were assumed to be equal.

Table 3.6-1 summarizes existing GHG emissions on the project islands. Emissions are shown for three primary sources:

- peat soil oxidation, which represents the largest GHG emissions source;
- farming and recreation activities; and
- recreation activities, which include vehicle trips associated with hunting and boating activities, as well as boating emissions.

Future No-Action GHG emissions would be generated by the same three primary sources listed above. Peat oxidation emissions involve oxidation of peat soil organic matter that produces CO_2 and methane. Exposed peat soils are oxidized continuously when they are not moist. The agricultural oxidation rate would be reduced by almost 90% if land were converted to reservoirs or wetlands (ICF 2007, 2008).

Farming emissions are based on existing estimates of farming activity and associated gasoline and diesel fuel use. Recreation emissions are based on the number of vehicle trips associated with various recreational uses.

Table 3.6-1 Existing Greenhouse Gas Emissions				
Emission Source	CO_2e (metric tons/year)	CO_2 (tons/year)	CH_4 (tons/year)	N_2O (tons/year)
Peat oxidation	231,737	255,374	–	–
Farming	2,296	2,488	0.5	0.1
Recreation	16	18	–	–
Total	**234,050**	**257,880**	**0.5**	**0.1**

Notes: CO_2e = CO_2e equivalent; CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrogen oxides

Estimates of peat oxidation are based on emission factors included in ICF (2008) and assume an estimated 15,022 acres with emissions of 17 tons of CO_2 per acre per year. Farming and recreation emissions are based on activity levels as specified in Appendix E, Table E-3.

Source: Environmental Science Associates 2014; adapted by AECOM in 2014

SIGNIFICANCE CRITERIA

The climate change analysis considered several criteria for determining the significance of effects. The analysis took into account both relevant criteria contained in Appendix G of the State CEQA Guidelines and project-specific criteria developed by the lead agency to address potential effects unique to the project's location and elements. Although this is an EIS for a NEPA project, at the time of this writing, there are no formal NEPA significance thresholds that are used to evaluate climate change and greenhouse gases. Thus, to provide a framework for evaluation of the project's GHG emissions, the State CEQA Guidelines have been used. These thresholds encompass the factors taken into account under NEPA to determine the significance of an action in terms of its context and the severity and intensity of its effects. In addition to the State CEQA Guidelines, local air quality management districts throughout California have begun to develop specific GHG thresholds and guidance that can provide additional direction of how GHG emissions should be evaluated. The Proposed Action and alternatives under consideration would result in a significant climate change effect if implementation of the project would:

- generate greenhouse gas emissions, either directly, indirectly, that may have a significant effect on the environment, or

- conflict with an applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of greenhouse gases.

To evaluate construction-related GHG emissions on a project-level basis, the California Department of Water Resources (DWR) has developed quantitative GHG thresholds for construction emissions in its Climate Action Plan (CAP) (California Department of Water Resources 2012). According to the DWR CAP, projects that would generate construction-related GHG emissions that exceed 25,000 metric tons of carbon dioxide equivalent (MT CO_2e) throughout the entire construction period, or that would generate annual construction emissions exceeding 12,500 MT CO_2e per year, would be considered to potentially adversely affect DWR's ability to achieve its GHG emission reduction goals. These thresholds have not been developed with the intent for use in CEQA or NEPA evaluations; rather they represent a level of emissions that would not adversely affect DWR's ability to achieve its GHG reduction goals. However, it is reasonable to assume that if a project would not interfere with the applicable GHG reduction goals, it would be considered to have a less-than-significant environmental effect. Therefore, because the Delta Wetlands project is a DWR project to which the DWR CAP applies, and due to the lack of another established threshold for construction, the DWR CAP threshold has been used to evaluate the project's construction-related climate change effects.

3.6.5 ENVIRONMENTAL CONSEQUENCES AND MITIGATION MEASURES

EFFECTS ANALYSIS

Effects related to climate change resulting from implementation of the project were not previously described in the 2001 FEIS. The effects conclusions and mitigation measures are summarized in Table 3.6-8.

No-Action Alternative

EFFECT CC-1 Increase in CO_2e Emissions on Project Islands During Construction. *No project-related construction activities would occur. Thus, there would be no effect.*

Because proposed facilities would not be constructed under the No-Action Alternative, and because no construction activities are proposed under the No-Action Alternative, there would no increase in CO_2e emissions from construction activities. **No effect** would occur.

EFFECT CC-2 Increase in CO_2e Emissions on Project Islands During Operation. *Long-term operational emissions of CO_2e would be generated at the project area under the No-Action Alternative, and would be substantially greater than any of the three action alternatives. This effect is less than significant.*

Future (2020) GHG emissions for the project islands under the No-Action Alternative are shown in Table 3.6-2. The No-Action Alternative would be similar to existing conditions in that peat oxidation represents the largest source of emissions, followed by farming and recreation. As compared to existing conditions, peat oxidation emissions would remain relatively unchanged, while farming and recreational activity and emissions would increase. As compared to GHG emissions under Alternatives 1, 2, and 3 (see Tables 3.6-4 and 3.6-6, below) agricultural activities under the No-Action Alternative would generate from approximately 99,000-185,800 metric tons/year more CO_2e. Although these emissions are greater than those that would be generated under any of the three action alternatives, agricultural activities are not subject to GHG regulations. Therefore, this effect is **less than significant**.

Table 3.6-2
Greenhouse Gas Emissions Under the No-Action Alternative

Emission Source	CO_2e (metric tons/year)	CO_2 (tons/year)	CH_4 (tons/year)	N_2O (tons/year)
Peat oxidation	231,737	255,374	–	–
Farming	7,457	8,105	0.7	0.3
Recreation	90	99	–	–
Total	**239,283**	**263,578**	**0.7**	**0.3**
Net change from existing	**5,233**	**5,698**	**0.3**	**0.2**

Notes: CO_2e = CO_2e equivalent; CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrogen oxides

Estimates of peat oxidation are based on emission factors included in ICF (2008) and assume an estimated 15,022 acres with emissions of 17 tons of CO_2 per acre per year. Farming and recreation emissions are based on activity levels as specified in Appendix E, Table E-4.

Source: Environmental Science Associates 2014; adapted by AECOM in 2014

EFFECT CC-3 Consistency with the Applicable GHG Reduction Plan. *The proposed change in land uses from agriculture to water infrastructure would not occur, and agricultural land uses are not subject to DWR's Climate Action Plan. No effect would occur.*

Under the No-Action Alternative, agricultural activities would continue and would intensify beyond existing conditions. However, the existing land use would not change and would remain agricultural land rather than water infrastructure, and because GHG emissions from agricultural land uses are not subject to DWR's CAP, there would be **no effect** associated with consistency with a GHG reduction plan.

Alternative 1 and Alternative 2 (Proposed Action)

The amount of GHGs that would be generated under Alternatives 1 and 2 are substantially similar; therefore, they are described together under this heading.

EFFECT CC-1 **Increase in CO_2e Emissions on Project Islands During Construction.** *Project implementation would generate CO_2e emissions from construction activities, but would not exceed the DWR CAP threshold. This effect is less than significant.*

Table 3.6-3 shows construction emissions for Alternatives 1, 2, and 3 (for comparative purposes). Alternatives 1 and 2 would generate approximately 2,431 metric tons of CO_2e per year during construction activities. As discussed above, this analysis relies on the DWR CAP thresholds to evaluate the project's construction-related climate change effects. As shown in Table 3.6-3, the annual/total construction emissions under Alternatives 1 and 2 would not exceed the DWR CAP threshold of 12,500 MT CO_2e per year. It should be noted that this analysis conservatively assumes that Alternative 1 and 2 construction activities would occur within one calendar year, when in reality both alternatives would like require approximately 1.5 years to complete. Thus, the annual emissions shown in Table 3.6-3 represent the worst-case annual construction emissions for Alternatives 1 and 2. Even with the shorter 1-year construction schedule modeled herein, construction emissions under Alternatives 1 and 2 would not exceed the annual or total (i.e., 25,000 MT CO_2e) DWR CAP thresholds. Thus, the construction-related GHG emissions under Alternatives 1 and 2 would not hamper achievement of DWR's overall GHG reduction goals, and therefore this effect is **less than significant**.

Table 3.6-3
Construction Emissions for Alternatives 1, 2 (Proposed Action), and 3

Alternative	CO_2e (metric tons/year)	CO_2 (tons/year)	CH_4 (tons/year)	N_2O (tons/year)
Alternatives 1 and 2[a]	2,431	2,661	0.03	0.06
Alternative 3[b]	3,910	4,255	0.09	0.17

Notes: CO_2e = CO_2e equivalent; CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrogen oxides

Construction emissions are based on activity levels as specified in Appendix E, Tables C-5 and C-6.

[a] Alternative 1 and 2 construction emissions were conservatively modeled assuming all construction activities would occur within one calendar year. In reality, it is anticipated that construction activities for Alternative 1 and 2 would require approximately 1.5 years.

[b] Alternative 3 construction emissions were conservatively modeled assuming all construction activities would occur with one calendar year. In reality, it is anticipated that construction activities for Alternative 3 would require approximately 2.5 years.

Source: Environmental Science Associates 2014; adapted by AECOM in 2014

Mitigation Measure: No mitigation is required.

EFFECT CC-2 **Increase in CO_2e Emissions on Project Islands During Operation.** *Following completion of construction activities, long-term operational emissions of CO_2e would be generated at the project area. However, project emissions would be substantially reduced as compared to existing conditions. This effect is beneficial and less than significant.*

Table 3.6-4 shows projected GHG emissions assuming electricity is used to pump water onto and off of the islands under Alternatives 1 and 2. Table 3.6-5 shows projected GHG emissions assuming diesel-fueled pumps are used instead of electrically-powered pumps under Alternatives 1 and 2. For both scenarios, peat oxidation

Table 3.6-4
Greenhouse Gas Emissions with Electricity Used for Pumping under Alternatives 1 and 2 (Proposed Action)

Emission Source	CO_2e (metric tons/year)	CO_2 (tons/year)	CH_4 (tons/year)	N_2O (tons/year)
Peat oxidation	125,825	138,659	–	–
Farming	979	1,054	0.1	0.07
Recreation	12	14	–	–
Pumping and Maintenance	633	689	0.05	0.026
Methane flux	3,001	–	157.5	–
Total	**130,451**	**140,416**	**158**	**0.097**
Net change from existing	**(103,599)**	**(117,464)**	**157**	**(0)**
Net change from No-Action	**(108,832)**	**(123,162)**	**157**	**(0)**

Notes: CO_2e = CO_2e equivalent; CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrogen oxides; ( ) = negative numbers

Estimates of peat oxidation are based on ICF (2007 and 2008). Farming, recreation, and pumping emissions are based on activity levels as specified in Appendix E, Table E-5. Methane flux is based on a report by Horne (2009). Assumes electricity used to pump water. GHG emissions associated with electricity used for pumping are based on emission factors provided by the California Climate Action Registry (2009). Alternatives 1 and 2 assume that 3 million kilowatt-hours per year would be required to pump water. On-road vehicle trip emissions estimated with EMFAC2011. Agricultural emissions estimated with OFFROAD2007.

Source: Environmental Science Associates 2014; adapted by AECOM in 2014

Table 3.6-5
Greenhouse Gas Emissions with Diesel Fuel Used for Pumping under Alternatives 1 and 2 (Proposed Action)

Emission Source	CO_2e (metric tons/year)	CO_2 (tons/year)	CH_4 (tons/year)	N_2O (tons/year)
Peat oxidation	125,825	138,659	–	–
Farming	979	1,054	0.12	0.07
Recreation	12	14	–	–
Pumping and Maintenance	1,786	1,951	0.27	0.04
Methane flux	3,001	–	157.5	–
Total	**131,603**	**141,678**	**157.9**	**0.1**
Net change from existing	**(102,446)**	**(116,202)**	**157.4**	**0.0**
Net change from No-Action	**(107,680)**	**(121,900)**	**157.1**	**(0.2)**

Notes: CO2e = CO2e equivalent; CO2 = carbon dioxide; CH4 = methane; N2O = nitrogen oxides; ( ) = negative numbers

Estimates of peat oxidation are based on ICF (2008). Farming, recreation, and pumping emissions are based on activity levels as specified in Appendix E, Table E-5. Methane flux is based on a report by Horne (2009). Assumes diesel fuel is used to pump water. GHG emissions associated with diesel fuel used for pumping are based on emission factors provided by the California Climate Action Registry (2009). Alternatives 1 and 2 assume 3 million kilowatt-hours per year are required to pump water. On-road vehicle trip emissions estimated with EMFAC2011. Agricultural emissions estimated with OFFROAD2007.

Source: Environmental Science Associates 2014; adapted by AECOM in 2014 constitutes the largest percentage of emissions, followed by recreation emissions, methane flux, and pumping. Methane flux estimates are based on a white paper prepared specifically for the project (Horne 2009). Methane flux emissions are produced primarily from the reduction of CO_2 under anaerobic conditions. Alternatives 1 and 2 would generate 130,451 metric tons CO_2e per year. However, compared to existing conditions, Alternatives 1 and 2 would reduce emissions by 103,599 metric tons CO_2e. Compared to the No-Action Alternative, Alternatives 1 and 2 would reduce emissions by 108,832 metric tons CO_2e. As shown in Table 3.6-5, if diesel fuel were used to power the water pumps, the net GHG benefit would be reduced slightly compared to using electrically-powered pumps. However, there still would be a substantial GHG benefit under the diesel powered–pump scenario. This benefit is attributable primarily to the reduction in peat oxidation GHG emissions. Therefore, this effect is **beneficial and less than significant**.

Mitigation Measure: No mitigation is required.

EFFECT CC-3 **Consistency with the Applicable GHG Reduction Plan.** *The project's design and purpose would be consistent with the goals and strategies of the DWR Climate Action Plan and AB 32 Scoping Plan. This effect is less than significant.*

In addition to evaluating a project's GHG emissions, it is important to consider a project's consistency with the applicable GHG reduction plan. Projects that are consistent with the goals and strategies of an applicable GHG reduction plan would be considered to have a less-than-significant effect on climate change. For this project, the applicable GHG reduction plans are the DWR CAP and the AB 32 Scoping Plan. As discussed in Effect CC-1, the construction emissions under Alternatives 1 and 2 would not exceed the DWR CAP thresholds and therefore would not be considered to adversely affect DWR's ability to achieve its GHG reduction goals. Implementation of Mitigation Measure AIR-MM-6, which includes measures to reduce exhaust GHG emissions from construction equipment and vehicles, would require that all construction equipment used as part of the project is in proper operating condition to maximize fuel combustion efficiency. Thus, the project's construction activities are considered to be consistent with the GHG reduction goals of the DWR CAP in terms of the amount of GHG emissions generated and the mitigation measures implemented to reduce construction-related GHG emissions. In addition, Effect CC-2 determined that long-term operational activities associated with Alternatives 1 and 2 would result in a net beneficial effect (i.e., reduction) with respect to GHG emissions, which would also be consistent with both the DWR CAP and the AB 32 Scoping Plan goal to reduce GHG emissions from all emission sectors. Long-term operational emissions are typically of greater concern due to their continuous nature compared to construction emissions that would cease following completion of construction. Therefore, on a long-term basis, Alternatives 1 and 2 would reduce GHG emissions from existing conditions. Furthermore, the project would augment current water storage facilities and construct improvements to existing levees to meet DWR's recommended standards for levee stability and flood control. These actions are consistent with DWR's CAP and the AB 32 Scoping Plan, which both highlight the need for climate adaptation strategies to prevent potential effects of climate change on the project such as flooding and sea level rise. In addition, the project would develop water storage facilities that would help adapt to potential reductions in water supply as a result of climate change. Therefore, considering the emissions levels and benefits of the project and the purpose and intent, Alternatives 1 and 2 would be consistent with the applicable GHG reduction plans and this effect would be **less than significant**.

Mitigation Measure: No mitigation is required.

Alternative 3

EFFECT CC-1 **Increase in CO_2e Emissions on Project Islands During Construction.** *Project implementation would generate CO_2e emissions from construction activities, but would not exceed the DWR CAP threshold. This effect is less than significant.*

Construction emissions of GHGs for Alternatives 1, 2, and 3 are shown in Table 3.6-3. Alternative 3 would generate approximately 3,910 metric tons of CO_2e per year. This analysis uses the DWR CAP thresholds to evaluate the effect of the project's construction-related climate change emissions. As shown in Table 3.6-3, the annual/total construction emissions under Alternative 3 would not exceed the DWR CAP threshold of 12,500 MT CO_2e per year. It should be noted that this analysis conservatively assumes that Alternative 3 construction activities would occur within one calendar year, when in reality they would likely require approximately 2.5 years to complete. Thus, the annual emissions shown in Table 3.6-3 represent the worst-case annual construction emissions under Alternative 3. Even with the shorter 1-year construction schedule modeled herein, the construction emissions under Alternative 3 would not exceed the annual or total (i.e., 25,000 MT CO_2e) DWR CAP thresholds. Thus, the construction emissions under Alternative 3 would not hamper achievement of DWR's overall GHG reduction goals and this effect is **less than significant**.

Mitigation Measure: No mitigation is required.

EFFECT CC-2 **Increase in CO_2e Emissions on Project Islands During Operation.** *Following completion of construction activities, long-term operational emissions of CO_2e would be generated at the project site. However, project emissions would be reduced as compared to existing conditions. This effect is beneficial and less than significant.*

GHG emissions under Alternative 3 assuming electricity is used to pump water onto and off of the islands are shown in Table 3.6-6. GHG emissions under Alternative 3 assuming that diesel-fueled pumps are used instead of electrically-powered pumps are shown in Table 3.6-7. Peat oxidation constitutes the largest percentage of emissions, followed by recreation emissions, methane flux, and pumping. Methane flux estimates are based on a white paper prepared specifically for the project (Horne 2009). Methane flux emissions are produced primarily from the reduction of CO_2 under anaerobic conditions. Alternative 3 would generate 33,987 metric tons of CO_2e per year, assuming electrically-powered pumps (Table 3.6-6), which is greater than either Alternatives 1 or 2. However, compared to existing conditions, Alternative 3 would reduce emissions by 200,063 metric tons CO_2e. Compared to conditions under the No-Action Alternative, Alternative 3 would reduce emissions by 205,296 metric tons CO_2e. As shown in Table 3.6-7, if diesel fuel were used to power the water pumps, the net GHG benefit would be reduced slightly as compared to using electrically-powered pumps. However, there still would be a substantial GHG benefit under the diesel powered–pump scenario. This benefit, though, is attributable primarily to the reduction in peat oxidation GHG emissions. This effect is **beneficial and less than significant**.

Mitigation Measure: No mitigation is required.

EFFECT CC-3 **Consistency with the Applicable GHG Reduction Plan.** *The project's design and purpose would be consistent with the goals and strategies of the DWR CAP and the AB 32 Scoping Plan. This effect would be less than significant.*

As discussed above, GHG reduction plans that are applicable to the Delta Wetlands project are the DWR CAP and the AB 32 Scoping Plan. As discussed in Effect CC-1, construction emissions under Alternative 3 would not exceed the DWR CAP thresholds and therefore would not be considered to adversely affect DWR's ability to achieve its GHG reduction goals. Thus, construction activities under Alternative 3 are considered to be consistent with the GHG reduction goals of the DWR CAP. In addition, Effect CC-2 determined that long-term operational activities associated with Alternative 3 would result in a net beneficial effect (i.e., reduction) with respect to GHG emissions, which would also be consistent with both the DWR CAP and the AB 32 Scoping Plan goal to reduce GHG emissions from all emission sectors. Furthermore, the project would augment current water storage facilities and construct improvements to existing levees to meet DWR's recommended standards for levee stability and flood control. These actions are consistent with the DWR CAP and AB 32 Scoping Plan, both of which highlight the need for climate adaptation strategies to help prevent potential effects of climate change on the project such as flooding and sea level rise. In addition, the project would develop water storage facilities that would help adapt to

Table 3.6-6
Greenhouse Gas Emissions with Electricity Used for Pumping under Alternative 3

Emission Source	CO_2e (metric tons/year)	CO_2 (tons/year)	CH_4 (tons/year)	N_2O (tons/year)
Peat oxidation	27,263	30,044	–	–
Farming	–	–	–	–
Recreation	12	14	–	–
Pumping and Maintenance	1,083	1,182	0.07	0.04
Methane flux	5,628	–	295.3	–
Total	**33,987**	**31,239**	**295**	**0**
Net change from existing	**(200,063)**	**(226,641)**	**294.9**	**(0.1)**
Net change from No-Action	**(205,296)**	**(232,339)**	**294.6**	**(0.3)**

Notes: CO_2e = CO_2e equivalent; CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrogen oxides; ( ) = negative numbers

Estimates of peat oxidation are based on ICF (2008). Farming, recreation, and pumping emissions are based on activity levels as specified in Appendix E, Table E-5. Methane flux is based on a report by Horne (2009). Assumes electricity is used to pump water. GHG emissions associated with electricity used to pump water are based on emission factors provided by the California Climate Action Registry (2009). Alternative 3 assumes 6 million kilowatt-hours per year are required for pumping. On-road vehicle trip emissions estimated with EMFAC2011. Agricultural emissions estimated with OFFROAD2007.

Source: Environmental Science Associates 2014; adapted by AECOM in 2014

Table 3.6-7
Greenhouse Gas Emissions with Diesel Fuel Used for Pumping under Alternative 3

Emission Source	CO_2e (metric tons/year)	CO_2 (tons/year)	CH_4 (tons/year)	N_2O (tons/year)
Peat oxidation	27,263	30,044	–	–
Farming	–	–	–	–
Recreation	12	14	–	–
Pumping and Maintenance	2,614	2,857	0.4	0.05
Methane flux	5,628	–	295.3	–
Total	**35,517**	**32,915**	**295.7**	**0.0**
Net change from existing	**(198,532)**	**(224,965)**	**295.3**	**(0.1)**
Net change from No-Action	**(203,766)**	**(230,663)**	**295**	**(0.3)**

Notes: CO_2e = CO_2e equivalent; CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrogen oxides; ( ) = negative numbers

Estimates of peat oxidation are based on ICF (2008). Farming, recreation, and pumping emissions are based on activity levels as specified in Appendix E, Table E-6. Methane flux is based on a report by Horne (2009). Assumes diesel fuel is used to pump water. GHG emissions associated with diesel fuel used to pump water are based on emission factors provided by the California Climate Action Registry (2009). On-road vehicle trip emissions estimated with EMFAC2011. Agricultural emissions estimated with OFFROAD2007.

Source: Environmental Science Associates 2014; adapted by AECOM in 2014

Table 3.6-8 Delta Wetlands Project SEIS Effects and Mitigation Measures for Climate Change
Alternatives 1 and 2 (Proposed Action)
Effect CC-1: Increase in CO_2e Emissions on project Islands during Construction (LTS) **Mitigation:** No mitigation is required.
Effect CC-2: Increase in CO_2e Emissions on project Islands during Operation (LTS-B) **Mitigation:** No mitigation is required.
Effect CC-3: Consistency with the Applicable GHG Reduction Plan (LTS) **Mitigation:** No mitigation is required.
Alternative 3
Effect CC-1: Increase in CO_2e Emissions on project Islands during Construction (LTS) **Mitigation:** No mitigation is required.
Effect CC-2: Increase in CO_2e Emissions on project Islands during Operation (LTS-B) **Mitigation:** No mitigation is required.
Effect CC-3: Consistency with the Applicable GHG Reduction Plan (LTS) **Mitigation:** No mitigation is required.
Notes: LTS = Less than significant; LTS-B = Less than significant and beneficial Sources: ICF 2010 and AECOM 2013

potential reductions in water supply as a result of climate change. Therefore, considering the emissions levels and benefits of the project and the purpose and intent, Alternative 3 would be consistent with the applicable GHG reduction plans and this effect would be **less than significant**.

Mitigation Measure: No mitigation is required.

3.6.6 SECONDARY AND CUMULATIVE EFFECTS

The effects of climate change are inherently cumulative in nature; therefore, a separate secondary and cumulative effects section for climate change is not required.

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3.7 CULTURAL RESOURCES

3.7.1 INTRODUCTION

This section describes recent changes to the existing environmental conditions and regulatory framework of the project study area, summarizes the unchanged affected environment, and describes changed environmental effects related to cultural resources for the project. A review and update of the 1995 DEIR/EIS cultural resources assessment was incorporated in the 2001 FEIS. Chapter 3M in the 2001 FEIS provided detailed information regarding cultural resources associated with the project and in the Sacramento-San Joaquin Delta (Delta) in general. The cultural resources effects of the project were analyzed most recently in Section 4.11 and Chapter 5 of the 2010 DEIR, which also served as a basis for this analysis. The 1995 DEIR/EIS, 2001 FEIS, 2010 DEIR are herein incorporated by reference.

The 2001 FEIS concluded that the project alternatives would affect cultural resources on and in the vicinity of the four project islands. Since that time, there have been minor changes in the "Affected Environment" and "Regulatory Framework/Applicable Laws, Regulations, Plans, and Policies" subsections. However, there have been no changes in the project that result in new significant adverse environmental effects or a substantial increase in the severity of previously identified significant adverse effects on cultural resources.

This cultural resources analysis has been updated to reflect the environmental conditions on and around the project islands. The section includes an expanded discussion of the potential archaeological sensitivity of Piper soils, resources newly identified as eligible for listing in the National Register of Historic Places (NRHP), resources identified since previous analyses that would require NRHP-eligibility assessments per the 1997 Programmatic Agreement (PA) which is discussed later in this SEIS, and changes in methods and circumstances since the 2001 FEIS.

The project would not have any direct effects on cultural resources in the places of use; the effects on cultural resources, if any, associated with the provision of project water to the places of use are addressed in the "Secondary and Cumulative Effects" subsection below and in Chapter 4, "Other Statutory Requirements."

SUMMARY OF CHANGES, NEW CIRCUMSTANCES, AND NEW INFORMATION

Substantial Changes in the Project

Since the 2001 FEIS was completed, there have been no substantial changes in the project resulting in new significant adverse effects or substantial increase in the severity of effects on cultural resources. The project no longer includes a proposal to construct new recreation facilities on the Reservoir or Habitat Islands; however, this change does not affect the analysis of cultural resources.

New Circumstances

Since the 2001 FEIS was completed, there have been no substantial new circumstances resulting in new significant adverse effects or substantial increase in the severity of effects on cultural resources.

New Information

There is no new information of substantial importance that would result in an increase in severity of effects on cultural resources. However, since the publication of the 2001 FEIS, new information and methods were developed for identification of and consultation concerning cultural resources for the 2010 DEIR, which are also herein incorporated by reference.

The key sources of new data and information used in the preparation of this section are:

- findings from updated records searches of the California Historical Resources Information System repositories;
- an updated reconnaissance-level survey of the built environment; and
- consultation with historical organizations, as well as Federally and non-Federally recognized Native American groups.

The new methods and practices used consist of changes in:

- the determination of cultural resource significance in consideration of the cultural values of indigenous groups, descendant groups, and historical entities;
- methods of identifying subsurface remains through remote sensing techniques;
- understanding of the types and depths of resources possible in Piper soils; and
- requirements in identifying the potential for deeply buried resources.

In assessing the significance of archaeological resources, cultural resource practitioners typically give the most weight to Criterion D of the NRHP significance criteria (see "Regulatory Framework/Applicable Laws, Regulations, Plans, and Policies" below). Essentially, cultural resource practitioners consider primarily the scientific information potential of archaeological resources when evaluating resource significance. Although this is acceptable practice under Federal and state cultural resources regulations, the application of Criterion D does not obviate the need to evaluate archaeological resources under Criteria A–C. Archaeological sites are often places where the ancestors of living communities are buried or where traditional activities are still carried out, the latter often qualifying the resource as a "traditional cultural property." Since the publication of works concerning the documentation of traditional cultural properties (e.g., King 2003; Parker and King 1998), it has become commonplace for cultural resource practitioners to find archaeological sites that contain human remains significant under Criterion A.

The effects and mitigation discussions include information on remote-sensing investigations as a means of resource identification and evaluation. Advances have been made with instruments such as ground-penetrating radar since the 1990s. Properly employed, remote-sensing instruments are invaluable tools for cultural resources identification in that the use of such instruments causes very little to no damage on cultural resources. (Conyers 2004; Conyers and Goodman 1997; Feder 1997:59–63.)

In light of these new methods, an updated investigation of the cultural resources in the project study area was conducted. Those efforts were reflected in an expanded discussion of Piper soils and an increase in the number of cultural resources determined eligible for the NRHP, among other findings. The archaeological potential of Piper soils in the project area of potential effect (APE) also addresses the potential for buried archaeological resources—that is, archaeological resources that are not evident on the present ground surface—in the APE. This issue was the focus of an archaeological study in the project vicinity by Rosenthal and Meyer (2004).

Summary of Environmental Commitments

Environmental commitments are measures incorporated by the project applicant as part of the project, meaning they are proposed as elements of the Proposed Action and are therefore considered in conducting the environmental analysis for each resource area of this SEIS. The purpose of environmental commitments is to reflect and incorporate best practices into the project that avoid, minimize, reduce, or offset potential environmental effects. A complete description of the environmental commitments that have been incorporated into the project since the 2001 FEIS is contained in Chapter 2, “Project Description and Alternatives” of this SEIS. There are no environmental commitments that would affect the analysis or conclusions related to cultural resources.

3.7.2 AFFECTED ENVIRONMENT

Existing cultural resources conditions are, for the most part, as they were presented in the 2001 FEIS (Section 3M), and have not changed since they were presented in the 2010 DEIR (Section 4.11 and Chapter 5); therefore, those documents are herein incorporated by reference. A detailed discussion of the prehistory and history of the project study area is contained in Appendix M1, “Cultural Context of the Delta Wetlands Project Islands” to the 2001 FEIS (herein incorporated by reference). A brief summary is provided below.

As stated in the 2001 FEIS, for purposes of this cultural resource analysis, the APE for Alternatives 1 and 2 consists of all four project islands including their surrounding levees *except* the southwest quarter of Holland Tract (see Exhibit 2-1 in Chapter 2, “Project Description and Alternatives”). The APE for Alternative 3 consists of all four project islands and their surrounding levees *including* the southwest quarter of Holland Tract. Downstream user areas are not included in the APE because the project has no potential to affect cultural resources in those areas.

The Delta Wetlands project area is situated at the interface of three different ethnolinguistic groups that used the region before European contact: the Plains Miwok, the Bay Miwok, and the Northern Valley Yokuts. All three groups occupied large, multiple-family villages. The preferred location for settlement was on elevated terraces near streams. Most settlements were inhabited permanently, except during a period of several weeks each year during the fall acorn harvest. Acorns were a staple augmented by various seeds, nuts, roots, berries, and greens. Fishing was very important in both the Miwok and Northern Valley Yokuts economies (ICF 2001:3M-4).

Until the Gold Rush of the 1840s and 1850s, the Delta was a network of waterways and natural islands of sand and peat. The Swamp and Overflow Land Act of 1850 opened the Delta for speculation by land developers (ICF 2001:3M-4). Land ownership of the Delta islands and development of reclamation districts began in the 1850s. Reclamation of Bouldin Island began in the 1870s. The first attempts to commercially grow asparagus were made on Bouldin Island in 1892, and the venture led to the fame of the Delta as the “asparagus capital” of the world.

In the 1880s and early 1890s, most farming was conducted by Chinese laborers. By the late 1890s, Japanese immigrants were steadily arriving in America and joining the Chinese work force. They were aided in their endeavor to find work by George Shima, a fellow immigrant who arrived in America in 1889. As early as 1900, Delta farmers devised a series of camps to facilitate cultivation of vast fields on the islands. By 1917, Shima had 17 camps on Webb Tract, 12 on Holland Tract, and 12 on Bacon Island, as well as headquarters on Webb Tract and Bacon Island (ICF 2001:3M-5). Shima operated the camps under a lease with the California Delta Farms Company, of which he was a shareholder. In addition, Shima maintained a residence at camp no. 1 on Bacon Island, and his headquarters office for the Delta was located in camp no. 3 on Bacon Island (ICF 2001:3M-5). Following completion of reclamation of Bouldin Island in 1918, 37 camps were also built around the perimeter of that island (ICF 2001:3M-5).

Today, Bacon Island, Bouldin Island, and Webb Tract are still used primarily for agriculture. Portions of Holland and Webb Tracts and Bouldin Island are used for grazing sheep and cattle, and there are hunting clubs and two marinas on Holland Tract.

RECORDS SEARCH

In August 2013, a records search was conducted at the Central California State University Stanislaus (CCIC) for Bouldin Island and Bacon Island (Environmental Science Associates 2013). The records search identified a total of 31 resources in the APE. Ten of the 31 resources are part of the Bacon Island Historic District and seven are isolates. Isolates do not qualify as historic properties and therefore are not discussed further in this section. The additional resources identified in the records search consist of artifact and trash scatters and concrete foundations

(CA-SJO-205H, CA-SJO-206H, CA-SJO-207H, CA-SJO-208H, and CA-SJO-210H), two historic-era boarding houses (CA-SJO-209H), levees (Old River Levees and Middle River Levees), and two bridges (Bacon Island Road Bridge and Mokelumne River Swing Truss Bridge). Four additional sites were recorded, but no information was provided on these resources. The boarding houses and levees have not been evaluated for NRHP or California Register of Historic Resources (CRHR) eligibility and the Bacon Island Bridge is no longer extant. The Mokelumne River Swing Truss Bridge meets the criteria for listing in the NRHP. The resources identified in the records search are listed in Table 3.7-1.

Table 3.7-1
Resources Identified in 2013 Central California State University Stanislaus Records Search

Primary Number	Trinomial	Island/Tract	Description
P-39-30	SJO-I-15H	Bacon Island	Isolate fragment of white porcelain Japanese blue floral transfer print.
P-39-31	SJO-I-16H	Bouldin Island	Isolate concrete foundation of a historic pumping station.
P-39-32	SJO-I-17H	Bouldin Island	Isolate consisting of three Chinese brown glazed ceramic vessel fragments within a plowed field.
P-39-33	SJO -I- 18 H	Bouldin Island	Isolate concrete pad.
P-39-35	SJO-I-20H	Bouldin Island	Isolate Chinese brown glazed earthenware vessel fragment.
P-39-36	SJO-I-21H	Bouldin Island	Isolate historic olive green bottle base fragment.
P-39-37	SJO-I-22H	Bouldin Island	Isolate concrete foundation that functioned as the foundation for two small structures. Structural remains present.
P-39-38	SJO-I-23H	Unknown	No information obtained.
P-39-67	CA-SJO-206H	Bouldin Island	Resource consists of a historic artifact scatter dating circa 1920 with possible feature. Disturbed by agricultural activities.
P-39-68	CA-SJO-208H	Bouldin Island	Resource consists of a concrete foundation, domestic trees, and historic trash.
P-39-231	CA-SJO-205H	Unknown	No information obtained.
P-39-322	CA-SJO-207 H	Bouldin Island	Resource consists of a linear historic trash scatter located in a plowed field. Possibly related to 1920’s agricultural use.
P-39-323	CS-SJO-209H	Bouldin Island	Resource consists of two historic boarding houses, a concrete pad, domestic plants, and historic trash. Disturbed by ongoing occupation.
P-39-324	CA-SJO-210H	Bouldin Island	Resource consists of one concrete foundation, one concrete pad, a fenced corral area with three cast iron bathtubs for water troughs, shed, pump station, and historic trash. Portions of site have been bulldozed.
P-39-325	CA-SJO-211H	Bacon Island	Resource is the historic location of Shima’s Camp 1, consisting of a two-story boarding house, mess hall, cook house, shower, toilet with septic tank, and associated Japanese and Anglo artifacts.
P-39-326	CA-SJO-212H	Bacon Island	Resource is the historic location of Shima’s Camp 2, consisting of two, 3-story structures, a shed, garden, warehouse, and associated artifacts.
P-39-327	CA-SJO-213H	Bacon Island	Resource is the historic location of Shima’s headquarters and Camp 3. It is now the site of Rancho del Rio including a total of 14 structures.
P-39-328	CA-SJO-214H	Unknown	No information obtained.

Table 3.7-1
Resources Identified in 2013 Central California State University Stanislaus Records Search

Primary Number	Trinomial	Island/Tract	Description
P-39-329	CA-SJO-215H	Unknown	No information obtained.
P-39-330	CA-SJO-216H	Bacon Island	Resource is the historic location of Shima's Camp 8, consisting of a boarding house, office, warehouse, and four modern structures.
P-39-331	CA-SJO-217H	Bacon Island	Resource is the historic location of Shima's Camp 9, consisting of a barn, shed, warehouse, and garden alongside six modern structures.
P-39-332	CA-SJO-218H	Bacon Island	Resource is the historic location of Shima's Camp 10, consisting of a dilapidated barn and a single-dwelling house. Currently occupied.
P-39-333	CA-SJO-219H	Bacon Island	Resource is the historic location of Shima's Camp 10 1/2, consisting of a cookhouse, bunkhouse, two houses, and three modern residences.
P-39-334	CA-SJO-220H	Bacon Island	Resource is the location of Shima's Camp 11, consisting of a warehouse, residence, yard, historic trash, and modern structures.
P-39-335	CA-SJO-221H	Unknown	No information obtained.
P-39-336	CA-SJO-222H	Bacon Island	Resource is the location of Shima's Camp 11, consisting of two sheds, bunkhouse, three residences, two boarding houses, two duplexes, a bathhouse, and 20 modern structures.
P-39-337	CA-SJO-223H	Bacon Island	Resource is the location of Shima's Camp 6, consisting of a two-story boarding house, a cement foundation pad from the original packing warehouse, and more recent sheds and trailers.
P-39-473	Isolate	Bacon Island	Resource consists of highly detailed, decorative 1906 swing bridge in good condition. Bridge is not in its original location.
P-39-4857	CA-SJO-220H	Bouldin and Bacon Islands	Resource consists of a large system of earthen levees that border portions of the Old River.
P-39-334	CA-SJO-221H	Bacon Island	Resource is the location of Shima's Camp 11, consisting of a warehouse, residence, yard, historic trash, and modern structures.
P-39-335	CA-SJO-222H	Unknown	No information obtained.
P-39-336	CA-SJO-223H	Bacon Island	Resource is the location of Shima's Camp 11, consisting of two sheds, a bunkhouse, three residences, two boarding houses, two duplexes, a bathhouse, and 20 modern structures.
P-39-337	Isolate	Bacon Island	Resource is the location of Shima's Camp 6, consisting of a two-story boarding house, cement foundation pad from the original packing warehouse, and more recent sheds and trailers.
P-39-473	CA-SJO-220H	Bacon Island	Resource consists of highly detailed, decorative 1906 swing bridge in good condition. Bridge is no longer extant.
P-39-4857	CA-SJO-221H	Bouldin and Bacon Islands	Resource consists of a large system of earthen levees that border portions of the Old River.

Sources: Environmental Science Associates 2013; data compiled by AECOM in 2013

PREVIOUS TECHNICAL STUDIES

In 1993, PAR Environmental Services (PAR) and BioSystems Analysis (BioSystems) completed technical studies for the project (ICF 2001:3M-3). The studies recommended NRHP/CRHR eligibility for the Bacon Island Historic District, CA-CCO-147, CA-CC0-678, and CA-SJO-208H. The State Historic Preservation Officer (SHPO) concurred with the findings for all four resources in 1994. As part of the documentation efforts, PAR and BioSystems conducted reconnaissance-level field surveys of the APE. In consultation with lead state and Federal agencies, a sampling strategy was devised to inventory the resources. For areas thought to have little potential for archaeological resources due to seasonal inundation, archaeologists conducted a 20% sample survey. Areas with high potential for prehistoric resources such as Piper sand mounds or those areas identified during archival research as having potential for historic or prehistoric remains were subjected to 100% survey coverage. Areas subjected to sample survey were selected to provide representative coverage of the APE. Archaeologists walked in transects 20-30 meters apart (20 meters on Piper soils) across those areas selected for survey. Approximately 100 acres of Piper sand mounds on Holland Tract were not surveyed because of access issues (ICF 2001:3M-3,5).

For built environment resources (buildings/structures), PAR inventoried and evaluated resources that were 50 years old or older at the time of the study. Since completion of the technical documentation, additional resources in the project APE may have reached 50 years of age, making them eligible for inventory and evaluation per Section 106 requirements. In addition, levees surrounding the islands in the APE are 50 years old or older. Per the PA, a historic property inventory and evaluation for all known resources in the APE will be conducted. Existing documentation indicates that updated studies were prepared for Bacon Island in 2010 (ICF 2010:4:11-7); however, additional analysis will need to be conducted for the remaining islands and levees within the APE to determine whether any built environment resources are of age and require inventory and evaluation.

RESOURCES ELIGIBLE FOR LISTING ON THE NATIONAL REGISTER OF HISTORIC PLACES

A number of NRHP-eligible resources have been identified in the project APE, as shown in Table 3.7-2. This section presents the NRHP-eligible resources on each island and discusses the changes that have occurred since the 2001 FEIS. In each case of a NRHP-eligible resource, the criteria under which the resource is eligible are explained to assist in defining appropriate mitigation measures.

Table 3.7-2
NRHP-Eligible Resources In the APE

NRHP-Eligible Resource	Island/Tract Name	NRHP Criteria
Bacon Island Rural Historic District	Bacon Island	A, B, D
Mokelumne River Swing Truss Bridge	Bouldin Island	A C
CA-SJO-208H	Bouldin Island	D
CA-SJO-210H	Bouldin Island	D
CA-CCO-147	Holland Tract	A, D
CA-CCO-593	Holland Tract	A
CA-CCO-678	Holland Tract	A

Notes: NRHP = National Register of Historic Places
Sources: ICF 2010:4.11-17, AECOM 2013, Environmental Science Associates 2013

BUILT ENVIRONMENT RESOURCES

Bacon Island Rural Historic District

The Bacon Island Rural Historic District was identified in the 2001 FEIS as having several important contributing elements, including the cultural landscape, water system, and the remaining architectural fabric of the camps, components of camp design, and archaeological remains. These remains are associated with ten labor camps that were determined eligible for the NRHP under Criteria A, B, C, and D.

However, since 2001, 20 buildings in the historic district have been destroyed through vandalism, fire, and deterioration, and one building was demolished during an emergency levee repair. Although the district retains integrity sufficient to convey significance under NRHP A, B, and D, it no longer appears to retain sufficient integrity to convey its significance under Criterion C. The built environment resources have suffered substantial loss of integrity through their complete demolition or their deterioration to the point of losing the materials and workmanship that illustrated the vernacular Craftsman architectural style for which they were deemed significant.

All of the cultural resources in the district are significant under NRHP Criteria A and B for their association with George Shima, a Japanese farmer influential in the development of Delta lands for agriculture following island reclamation. Mr. Shima employed Japanese tenant farmers during the early 1900s when laws prohibited Asians from owning land. Buildings and structures, although no longer contributing for their architectural integrity, still provide information regarding camp layout and function. Finally, seven known archaeological sites that contain material important to ongoing research on Japanese-American culture are present on the island (Criterion D). Consequently, the Bacon Island Rural Historic District appears to be eligible under NRHP Criteria A, B, and D, and therefore resources that compose the district are considered historic properties.

MOKELUMNE RIVER SWING TRUSS BRIDGE

The Mokelumne River Swing Truss Bridge is located on Bouldin Island. It was constructed in 1941-1942 and is a historic moveable steel swing truss design bridge. The California Department of Transportation found the bridge eligible for NRHP listing in 2001. It is significant under NRHP Criterion A for its association with the historical development of transportation in the Delta region and under Criterion C for its design.

ARCHAEOLOGICAL SITES

CA-SJO-208H

CA-SJO-208H is a historic archaeological site located on Bouldin Island that is eligible for the NRHP under Criterion D. No changes to the known existing conditions as of 2001 on Bouldin Island have been identified.

CA-SJO-210H

CA-SJO-210H is a historic archaeological site located on Bouldin Island consisting of the remains of George Shima's Camp #16, which was established in 1916 and used until World War II. A records search performed for the 2010 DEIR show this site was recorded by PAR & Associates as part of the Delta Wetlands Water Storage Project; it does not appear in the associated report (PAR & Associates 1989). Because no documentation exists indicating it was evaluated and found not eligible for either the NRHP or the CRHR, CA-SJO-210H is considered eligible for the NRHP under Criterion D.

CA-CCO-147

CA-CCO-147 is a prehistoric archaeological site that contains intact human remains and appears to retain a substantial archaeological deposit. The site is eligible for listing in the NRHP under Criteria A and D because of its data potential (Criterion D) and because of the importance that Native Americans place on burials (Criterion A).

CA-CCO-593

CA-CCO-593 is a prehistoric archaeological site on Holland Tract that was determined not eligible for the NRHP because it lacks archaeological integrity. However, a number of disarticulated human skeletal remains were observed during the excavation. Sites that have human remains are considered to be significant cultural resources, and such sites therefore can be considered eligible for the NRHP because of their association with important events, specifically because they hold cultural importance to Native Americans. This renders the site now eligible for the NRHP under Criterion A.

CA-CCO-678

CA-CCO-678 does not contain intact archaeological deposits and does not meet NRHP eligibility Criterion D for its archaeological value. However, intact human remains that have importance to Native Americans have been found at this site. Sites that have human remains are commonly eligible for the NRHP because of their association with important events, specifically because they hold cultural importance to Native Americans. Therefore, the site is eligible for the NRHP under Criterion A.

ADDITIONAL RESOURCES

In addition to the resources discussed in the previous documentation, the APE includes levees surrounding the islands and may also include built environment resources that have become 50 years old or more since the completion of the technical studies in 1993.

PREHISTORIC ARCHAEOLOGICAL SENSITIVITY

Piper Soils

Among areas of greatest prehistoric archaeological sensitivity in the Delta region are those where Piper soils are located (ICF 2007:20). The Piper sand mounds of the Delta are natural remnant soil formations often associated with Early and Middle Horizon archaeological sites that once stood above the level of the surrounding tule marshes. Because of their elevation above the frequently inundated peat soils, these sand mounds often were used by prehistoric peoples for village and burial sites (ICF 2007:20).

Numerous excavations in the Delta area have shown that Piper sand formations are indicators for buried prehistoric sites that include habitation debris and human burials. Typically, there is little to no superficial indication of these sites, and as a result, many of the archaeological finds were inadvertent discoveries associated with ground-disturbing grading or quarrying activities. (ICF 2007:29–30.) It is possible more sites exist on the project islands than have been discovered to date, although few portions of the islands are above sea level.

Several factors affect the visibility of Piper sand formation archaeological sites, including sea-level fluctuation, dune formation, and increases in sedimentation rates from human activities such as hydraulic mining in the Sierra Nevada foothills. Because of this, traditional methods of surface survey are not as effective for locating archaeological sites in the Delta region. The most successful archaeological studies of Piper sand sites have consisted of extensive subsurface exploration that has often been rewarded with a wealth of new data on the early inhabitants of this culturally and environmentally unique region. (ICF 2007:29–30.)

Piper Soils on Holland Tract

There are 100 acres of Piper sand mounds on Holland Tract that would be affected by Alternative 3 only. These Piper sand mounds have not been surveyed because they are on property that is not owned or under the control of the project applicant, and the current owner did not permit the area to be surveyed. Piper soils may indicate sensitivity for the presence of prehistoric period archaeological sites.

Piper Soils on Webb Tract

No cultural resources have been identified on Webb Tract. Piper sand mounds on Webb Tract have been surveyed, but no archaeological resources were found. Piper soils may indicate sensitivity for the presence of prehistoric period archaeological sites.

3.7.3 Regulatory Framework/Applicable Laws, Regulations, Plans, and Policies

Federal applicable laws and regulations are provided because they are required under NEPA. State applicable laws and regulations are provided for informational purposes and to assist with NEPA review. USACE has considered applicable state, regional, and local plans and ordinances as a part of the environmental review process for this SEIS, where applicable.

Federal

Section 106 of the National Historic Preservation Act

The project requires a permit from USACE under Section 404 of the Clean Water Act (CWA) and under Section 10 of the Rivers and Harbors Act. As the Federal permitting agency, USACE is required to comply with Section 106 of the National Historic Preservation Act (NHPA) of 1966 as amended, and its implementing regulations (36 Code of Federal Regulations [CFR] Part 800).

Section 106 of the NHPA requires that, before beginning any Federally permitted undertaking, the Federal agency must take into account the effects of the undertaking on historic properties and afford the Advisory Council on Historic Preservation) an opportunity to comment on these actions (the term “historic properties” is defined in the section below entitled National Register of Historic Places. The Section 106 process has five basic steps.

1. Initiate the Section 106 consultation process.
2. Identify and evaluate historic properties.
3. Assess effects of the undertaking on historic properties.
4. Resolve any adverse effects of the project on historic properties in consultation with the State Historic Preservation Officer (SHPO), resulting in a Memorandum of Agreement (MOA) that spells out specific measures to avoid or mitigate effects on the historic property.
5. Proceed in accordance with the MOA.

Specific regulations regarding compliance with Section 106 state that, although the tasks necessary to comply with Section 106 may be delegated to others, the Federal agency (in this case, USACE) is ultimately responsible for ensuring that the Section 106 process is completed according to statute.

Summary of Past Project Section 106 Compliance

Under circumstances defined at 36 CFR 800, a Federal agency may execute and implement a PA to satisfy the requirements of Section 106. Such an agreement document was executed among USACE, State Water Resources Control Board (SWRCB), SHPO, Advisory Council on Historic Preservation (ACHP), and the project applicant regarding the implementation of the project in December 1997 (attached as Appendix H). The PA calls for an inventory of the remaining unsurveyed portion of the project area, and the evaluation of any properties recorded as a result of this survey for NRHP-eligibility. The PA also calls for the development and implementation of a Historic Properties Management Plan (HPMP), which will call for, among other tasks, the development of monitoring plans and data recovery plans as necessary. Other subjects addressed in the PA include procedures for: changes in the project or project area; inadvertent discovery of cultural materials or human remains during project implementation; review, consultation, and coordination among USACE, SWRCB, SHPO, and ACHP; curation and disposition of cultural and human remains; and dispute resolution. Per the PA, interested parties including Native Americans as identified through consultation with the Native American Commission (NAHC), Japanese American groups and individuals, and other appropriate ethnic groups would be contacted about the HPMP and the planning and conducting of the project. To date, the HPMP has not yet been implemented for the project.

National Register of Historic Places

Section 106 requires Federal agencies, or those they fund or permit, to consider the effects of their actions on historic properties—that is, properties that may be eligible for listing or are listed in the NRHP. To determine whether an undertaking could affect NRHP-eligible properties, cultural resources (including archeological, historical, and architectural properties) must be inventoried and evaluated for the NRHP. To qualify for listing in the NRHP, a property must be at least 50 years old or, if less than 50 years old be of exceptional historic significance. It must represent a significant theme or pattern in history, architecture, archaeology, engineering, or culture at the local, state, or national level. A property must meet one or more of the four criteria listed below. The criteria for evaluation of the eligibility of cultural resources for listing in the NRHP are defined in 36 CFR 60.4 as follows:

The quality of significance in American history, architecture, archaeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association, and

(A) that are associated with events that have made a significant contribution to the broad patterns of our history; or

(B) that are associated with the lives of persons significant in our past; or

(C) that embody the distinctive characteristics of a type, period or method of construction, or that represent the work of a master, or that possess high artistic value, or that represent a significant and distinguishable entity whose components may lack individual distinction; or

(D) that have yielded, or may be likely to yield, information important in prehistory or history.

In addition to meeting the significance criteria, potentially historic properties must possess integrity to be considered eligible for listing in the NRHP. Integrity refers to a property’s ability to convey its historic significance (National Park Service 1991). Integrity is a quality that applies to historic resources in seven specific ways: location, design, setting, materials, workmanship, feeling, and association. A resource must possess two, and usually more, of these kinds of integrity, depending on the context and the reasons the property is significant.

3.7.4 Analysis Methodology

This analysis of environmental effects on cultural resources was prepared by considering the significance criteria listed below in relationship to anticipate project-related activities. Procedural changes in cultural resources management, as outlined above, were also considered.

SIGNIFICANCE CRITERIA

The basis for determining adverse effects is in accordance with regulations implementing Section 106 of the NHPA. Under the NHPA, if it is determined that historic properties may be affected by an undertaking, the agency proceeds with the Section 106 process, assessing adverse effects. The criteria of adverse effects are found in Section 800.5(a)(1) of the regulations of the NHPA. According to those criteria, an adverse effect occurs when the integrity of the historic property may be diminished by the undertaking through alteration of the characteristics that qualify the property for the NRHP. Such alteration can be a direct result of or an indirect consequence of the undertaking. The criteria of adverse effects state:

> An adverse effect is found when an undertaking may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the National Register in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. Consideration shall be given to all qualifying characteristics of a historic property, including those that may have been identified subsequent to the original evaluation of the property's eligibility for the National Register. Adverse effects may include reasonably foreseeable effects caused by the undertaking that may occur later in time, be farther removed in distance or be cumulative.

Adverse effects on historic properties include, but are not limited to:

- physical destruction of or damage to all or part of the property;
- alteration of a property, including restoration, rehabilitation, repair, maintenance, stabilization, hazardous material remediation, and provision of handicapped access, that is not consistent with *The Secretary of Interior's Standards for the Treatment of Historic Properties* (36 Part 68) and applicable guidelines;
- removal of the property from its historic location;
- change of the character of the property's use or of physical features within the property's setting that contribute to its historic significance;
- introduction of visual, atmospheric, or audible elements that diminish the integrity of the property's significant historic features;
- neglect of a property that causes its deterioration, except where such neglect and deterioration are recognized qualities of a property of religious and cultural significance to an Indian tribe or Native Hawaiian organization; and
- transfer, lease, or sale of property out of federal ownership or control without adequate and legally enforceable restrictions or conditions to ensure long-term preservation of the property's historic significance.

The Proposed Action or alternatives under consideration would have a significant, adverse effect on cultural resources if they would do any of the above.

3.7.5 ENVIRONMENTAL CONSEQUENCES AND MITIGATION MEASURES

EFFECTS ANALYSIS

Effects on cultural resources resulting from implementing the project were described in the 2001 FEIS and are listed in Table 3.7-3. Where there have been no changes to the effect analysis or conclusions, the 2001 FEIS is herein incorporated by reference, and the effect conclusions and mitigation measures are summarized briefly in the following section.

No-Action Alternative

EFFECT CUL-1 **Destruction of Historic Buildings and Structures from Agricultural Practices.** *The use of historic structures as boarding houses could affect their integrity and potential eligibility under NRHP. This effect is less than significant.*

Under the No-Action Alternative, agricultural practices would affect cultural resources from the use of historic structures as boarding houses. Normal wear and tear and modification of the structures without concern for their historic integrity could reduce their "significance" (as that term is defined under the NRHP). Continued use of the structures in this manner probably would result in a need for replacement, perhaps accompanied by demolition of the historic structures. Occupation of the historic structures provides some protection because they are less vulnerable to vandalism. Vandalism does occur currently, however, to some degree, and greater human presence as a result of increased hunting could slightly elevate that risk. The advanced stage of deterioration of the structures may have been accelerated by the normal wear and tear from the natural elements (e.g., rain, wind, sun, vegetation). Damage to historic structures resulting from agricultural practices and continued vandalism under the No-Action Alternative would not substantially change from existing conditions. Therefore, this effect is **less than significant**.

EFFECT CUL-2 **Destruction of Levees and Built Environment Resources from Agricultural Practices.** Agricultural activities could affect levees and unevaluated built environment resources within the APE. This effect is less than significant.

Activities associated with the No-Action Alternative include grazing, plowing, and planting and levee construction and replenishment. Levees and built environment resources are located within the APE that have not been evaluated for NRHP significance. However, the continuation of existing agricultural practices and intensified agriculture proposed under the No-Action Alternative would not substantially alter the levees or unevaluated built environment resources. Therefore, this effect is **less than significant**.

EFFECT CUL-3 **Disturbance to Archaeological Remains from Agricultural Practices.** *Agricultural activities could disturb buried resources within the project area; however, these activities would not substantially alter from the existing conditions. This effect is less than significant.*

Activities associated with the No-Action Alternative consist of intensified agricultural practices on all four islands, as well as an intensified for-fee hunting program. Resources consist of: CA-SJO-208H on Bouldin Island, CA-SJO-210H on Bouldin Island, CA-CCO-147 on Holland Tract, CA-CCO-593 on Holland Tract, and CA-CCO-678 on Holland Tract. In addition, Piper soils, which are potentially sensitive archaeological areas, are located on Holland and Webb Tracts. Grazing, plowing, and planting and levee construction and replenishment are activities associated with intensified agricultural practices. These activities may disturb archaeological remains or potentially sensitive archaeological areas in the APE. However disturbance of previously unknown and undiscovered archaeological resources would not substantially change from the existing conditions. Therefore, this effect is **less than significant**.

EFFECT CUL-4 **Disturbance to Human Remains as a Result of Agricultural Activities.** *Ground-disturbing activities could uncover previously undiscovered human burials within the project area; however, these activities would not cause additional disturbance to the human remains. This effect is less than significant.*

Although the No-Action Alternative would entail intensified agricultural activities, disturbance of human remains would not substantially change from existing conditions. Intact burials that are inadvertently discovered in known sites during agricultural activities must be treated according to the provisions of the California Public Health and Safety Code and the Public Resources Code. If agreement between the landowner and the NAHC cannot be reached, the landowner nonetheless is required to re-inter the human remains and items associated with Native

American burials with appropriate dignity on the property in a location not subject to further subsurface disturbance. Any disturbance or removal of human remains without authority of law is a felony under the California Public Health and Safety Code. The intensified agricultural activities under the No-Action Alternative would not cause additional disturbance to human remains; therefore, this effect is **less than significant**.

Alternative 1 and Alternative 2 (Proposed Action)

The effects analysis and mitigation measures for Alternatives 1 and 2 are the same; therefore, they are described together under this heading.

EFFECT CUL-1	Destruction of Historic Buildings and Structures on Bacon Island and Bouldin Island. *Because properties on Bacon Island are eligible for NRHP listing as a historic district, the effect of implementation of Alternatives 1 and 2 on the district as a whole must be assessed. In addition, implementation of Alternatives 1 and 2 may damage the Mokelumne River Swing Truss Bridge, which is eligible for NRHP listing. This effect is significant.*

The majority of the buildings contributing to the eligibility of the Bacon Island Rural Historic District would be adversely affected by reconstruction of the levees and inundation because all buildings are planned for demolition. Most of the structures and bridge lie on the perimeters of the islands in areas that would be disturbed by reconstruction of levees. Structures on the sides or near the bases of levees would be subject to adverse effects resulting from fill placement. This effect is **significant**.

Affected Resources

- Bacon Island Rural Historic District
- Mokelumne River Swing Truss Bridge

Mitigation Measure CUL-MM-1: Prepare and Implement a Historic Properties Treatment Plan.

Prior to implementation of any project activities, per the requirements of the PA the lead agency will ensure that a Historic Properties Treatment Plan (HPTP) is prepared and implemented by individuals who meet the Secretary of Interior’s Standards for Archaeology, History, and Architectural History. The HPTP will include the following components:

Mitigation Measure CUL-MM-1a: Complete Historic Research, Measured Drawings, and Photographic Documentation of the NRHP-Eligible Property.

This documentation will meet the minimum requirements of the Historic American Building Survey/Historic American Engineering Record/Historic American Landscape Survey for resources with national significance. This component of the HPTP will be completed before components CUL-MM-1c and CUL-MM-1d so the results may be integrated into the products required by those components.

Mitigation Measure CUL-MM-1b: Prepare and Implement an Archaeological Resources Data Recovery Plan.

This plan will specify how significant archaeological data will be recovered from the sites, analyzed, and reported to professionals and the public. This component of the HPTP will be completed before components CUL-MM-1c and CUL-MM-1d so the results may be integrated into the products required by those components.

Mitigation Measure CUL-MM-1c: Produce a Publication to Disseminate Historical Information Regarding the NRHP-Eligible Property to the Public.

This document should combine historical photographs with information gathered from historical research and interviews to describe the history of the NRHP-eligible properties and its relevance to modern society. The publication should be prepared for use by schools, historical societies, local museums, and the general public.

Mitigation Measure CUL-MM-1d: Prepare a Video That Disseminates Historical Information and Explains the Character-Defining Features of the NRHP-Eligible Property to the Public.

This production should be prepared to meet the technical requirements for airing on the Public Broadcasting System (PBS), as specified in the PBS producers' handbook.

Implementing Mitigation Measures CUL-MM-1a through CUL-MM-1d would reduce this significant effect, but not to a less-than-significant level because project implementation would still result in the damage or destruction of NRHP-eligible properties. Therefore this effect is **significant and unavoidable**.

EFFECT CUL-2	**Destruction of Levees and Unevaluated Built Environment Resources.** The levees and the built environment resources within the APE have not been assessed and could be eligible for NRHP listing; therefore, implementation of Alternatives 1 and 2 may damage these resources. The effect is potentially significant.

Levees and unevaluated built environment resources within the APE would be adversely affected by the reconstruction of levees and inundation if the resources are determined to be NRHP-eligible. The eligible resources would be damaged or destroyed through implementation of Alternatives 1 or 2 and the physical characteristics that convey their significance would be altered. This effect is **potentially significant**.

Affected Resources

- Levees and Unevaluated Built Environment Resources

Mitigation Measure CUL-MM-2: Inventory and Evaluate Built Environment Resources.

Per the PA, prior to implementation of any project activities, the project applicant will ensure that all resources in the APE 50 years old or older have been inventoried and evaluated for NRHP significance. The assessments will be prepared according to the Secretary of the Interior's standards and guidelines for evaluated resources. In accordance with the PA, if resources are found not eligible for the NRHP no further considerations need to be given to these properties.

Mitigation Measure CUL-MM-1: Prepare and Implement a Historic Properties Treatment Plan.

Per the PA, if identification efforts result in the determination of NRHP eligibility, the project applicant will ensure that prior to implementation of any project activities a HPTP is prepared and implemented. The HPTP will include the following components:

Mitigation Measure: Implement Mitigation Measure CUL-MM-1a (Complete Historic Research, Measured Drawings, and Photographic Documentation for NRHP-Eligible Property).

Mitigation Measure: Implement Mitigation Measure CUL-MM-1c (Produce a Publication to Disseminate Historical Information regarding the NRHP-Eligible Property to the Public).

Mitigation Measure: Implement Mitigation Measure CUL-MM-1d (Prepare a Video That Disseminates Historical Information and Explains the Character-Defining Features of the NRHP-Eligible Property to the Public).

Implementing Mitigation Measures CUL-MM-2, CUL-MM-1a, CUL-MM-1c, and CUL-MM-1d would reduce this potentially significant effect, but not to a less-than-significant level because project implementation would still result in the damage or destruction of NRHP-eligible properties. Therefore, this effect is **significant and unavoidable.**

EFFECT CUL-3 Disturbance to Archaeological Remains as a Result of Compaction, Inundation, Wave-Induced Erosion, or Habitat Development and Management. *Because the value of archaeological resources often depends on their integrity, project activities that disturb buried resources could change their status under the NRHP. This effect is potentially significant.*

As discussed above in the "Affected Environment" subsection, the Piper soils are among the areas of greatest prehistoric archaeological sensitivity in the Delta region. The Piper sand mounds of the Delta are natural remnant soil formations typically associated with Early and Middle Horizon archaeological sites that once stood above the level of the surrounding tule marshes. Because of their elevation above the frequently inundated peat soils, these sand mounds often were used by prehistoric peoples for village and burial sites. In addition to Piper soils, buried archaeological remains may be present in other locations within the APE. Proposed activities may disturb these remains or sensitive archaeological areas. Because the value of archaeological resources often depends on their integrity, project activities that disturb buried resources could render them ineligible, which would be an adverse effect under NEPA. Implementation of Alternatives 1 or 2 may result in the physical destruction of eligible buried resources; therefore, this effect is **potentially significant**.

Affected Resources

- Buried archaeological remains

Mitigation Measure: Implement Mitigation Measure CUL-MM-1 (Prepare and Implement a Historic Properties Treatment Plan).

Per the PA, the project applicant will ensure the HPTP includes the following components:

Mitigation Measure: Implement Mitigation Measure CUL-MM-1b (Prepare and Implement an Archaeological Resources Data Recovery Plan) (if necessary).

Mitigation Measure CUL-MM-1e: Provide Methods and Guidance for Subsurface Testing in the Form of Remote Sensing and Excavation.

This testing will determine the presence or absence of significant archaeological remains within archaeologically sensitive areas of the project APE. If significant archaeological resources are identified, prepare and implement an archaeological resources data recovery plan that specifies how significant archaeological data will be recovered from the APE, analyzed, and reported to professionals and the public. Specify notification procedures in the event of discovery of cultural materials in archaeologically sensitive areas. The HPMP will include a monitoring plan to address effects resulting from inadvertent discovery of cultural resources during ongoing project operations and will outline treatment and management requirements for these resources.

Mitigation Measure CUL-MM-1f: Steps to Implement for the Discovery of Cultural Resources.

Per the PA, if previously unidentified cultural resources are discovered during project construction or operation, the project applicant, in consultation with USACE, SWRCB, and SHPO, shall collect sufficient information to determine whether the resources are eligible for the NRHP and determine appropriate treatment. The steps necessary to determine NRHP eligibility and appropriate treatment for unanticipated discoveries will be outlined in the HPMP and in a monitoring plan.

Implementing Mitigation Measures CUL-MM-1b (if necessary), CUL-MM-1e, and CUL-MM-1f, would reduce this potentially significant effect to a **less-than-significant** level because a treatment plan would be prepared and implemented.

EFFECT CUL-4	Disturbance to Human Remains as a Result of Compaction, Inundation, Wave-Induced Erosion, Habitat Development and Management, or Vandalism. *Ground-disturbing activities could uncover previously undiscovered human burials within the project area. This effect is potentially significant.*

Numerous early Native American human internments have been documented within the Delta region. California law recognizes the need to protect historic-era and Native American human burials, skeletal remains, and items associated with Native American interments from vandalism and inadvertent destruction. Ground-disturbing activities, such as plowing and planting associated with habitat management or enhancement, or excavation activities for project-related facilities and levee improvements, could uncover previously undiscovered human burials. Implementation of Alternatives 1 or 2 may result in disturbance of intact human burials as a result of project-related construction activities; this effect is **potentially significant**.

Affected Resources

- Human Burials

Mitigation Measure: Implement Mitigation Measure CUL-MM-1 (Prepare and Implement a Historic Properties Treatment Plan).

In accordance with the PA, the project applicant will ensure the HPTP includes the following components:

Mitigation Measure: Implement Mitigation Measure CUL-MM-1b (Prepare and Implement an Archaeological Resources Data Recovery Plan).

Mitigation Measure: Implement Mitigation Measure CUL-MM-1e (Provide Methods and Guidance for Subsurface Testing in the Form of Remote Sensing and Excavation).

Mitigation Measure CUL-MM-1g: Negotiate, Prepare, and Implement a Preburial Agreement with the Most Likely Descendant (as Determined by the Native American Heritage Commission) of Potential Native American Interments Located in Webb Tract.

Specific mitigation and/or treatment in relation to the potential for burials will be dependent upon this negotiation. Mitigation and/or treatment typically include adoption of project design guidelines that minimize disturbance to sensitive areas as well as methods and guidance for: identifying intact interments; recovery, treatment, and reburial of interments; and the ultimate ownership of human remains and burial items. Mitigation and/or treatment also typically include methods and guidance in the event of an inadvertent discovery of human remains.

Implementing Mitigation Measures CUL-MM-1b, CUL-MM-1e, and CUL-MM-1g would reduce the severity of this effect to a **less-than-significant** level because an archaeological resources data recovery plan would be prepared and implemented and if resources are encountered, appropriate treatment for human burials would be implemented following consultation with the NAHC.

Alternative 3

EFFECT CUL-1 **Destruction of Historic Buildings and Structures from Demolition or Destruction on Bacon Island and Bouldin Island.** *Because properties on Bacon Island are eligible for NRHP listing as a historic district, the effect of implementation of Alternative 3 on the district as a whole must be assessed. Implementation of Alternative 3 may also damage NRHP-eligible Mokelumne River Swing Truss Bridge. This effect is significant.*

As described under Alternatives 1 and 2, the majority of the buildings contributing to the eligibility of the Bacon Island Rural Historic District and Mokelumne River Swing Truss Bridge would be affected by reconstruction of the levees and inundation under Alternative 3 because all buildings are planned for demolition or destruction. Most of the structures lie on the perimeters of the islands in areas that would be disturbed by reconstruction of levees. Therefore, a **significant** effect would occur.

Affected Resources

- Bacon Island Rural Historic District
- Mokelumne River Swing Truss Bridge

Mitigation Measure: Implement Mitigation Measure CUL-MM-1 (Prepare and Implement a Historic Properties Treatment Plan).

Per the PA, the project applicant will ensure the HPTP includes the following components:
Mitigation Measure: Implement Mitigation Measure CUL-MM-1a (Complete Historic Research, Measured Drawings, and Photographic Documentation of the NRHP-Eligible Property).

Mitigation Measure: Implement Mitigation Measure CUL-MM-1b (Prepare and Implement an Archaeological Resources Data Recovery Plan).

Mitigation Measure: Implement Mitigation Measure CUL-MM-1c (Produce a Publication to Disseminate Historical Information regarding the NRHP-Eligible Property to the Public).

Mitigation Measure: Implement Mitigation Measure CUL-MM-1d (Prepare a Video That Disseminates Historical Information and Explains the Character-Defining Features of the NRHP-Eligible Property to the Public).

Implementing Mitigation Measures CUL-MM-1a through CUL-MM-1d would reduce this significant effect, but not to a less-than-significant level because project implementation would still result in the damage or destruction of NRHP-eligible properties. Therefore, this effect is **significant and unavoidable**.

EFFECT CUL-2 **Destruction of Levees and Unevaluated Built Environment Resources.** The levees and the built environment resources within the APE have not been assessed and could be eligible for NRHP listing; therefore, implementation of Alternative 3 may damage these resources. This effect is potentially significant.

Levees and unevaluated built environment resources within the APE would be adversely affected by the reconstruction of levees and inundation under Alternative 3 if the resources are determined to be eligible for listing in the NRHP. The eligible resources would be adversely affected by the proposed reconstruction and inundation as they would be damaged or destroyed through construction activities and their character-defining features would be altered. This effect is **potentially significant**.

Affected Resources

- Levees and Unevaluated Built Environment Resources

Mitigation Measure: Implement Mitigation Measure CUL-MM-2 (Inventory and Evaluate Built Environment Resources).

Mitigation Measure: Implement Mitigation Measure CUL-MM-1 (Prepare and Implement a Historic Properties Treatment Plan).

Per the PA, if identification efforts result in the determination of NRHP eligibility, the project applicant will ensure that prior to implementation of any project activities, a HPTP is prepared and implemented. The HPTP will include the following components:

Mitigation Measure: Implement Mitigation Measure CUL-MM-1a (Complete Historic Research, Measured Drawings, and Photographic Documentation for NRHP-Eligible Properties).

Mitigation Measure: Implement Mitigation Measure CUL-MM-1c (Produce a Publication to Disseminate Historical Information regarding the NRHP-Eligible Properties to the Public).

Mitigation Measure: Implement Mitigation Measure CUL-MM-1d (Prepare a Video That Disseminates Historical Information and Explains the Character-Defining Features of the NRHP-Eligible Properties to the Public).

Implementing Mitigation Measures CUL-MM-2, CUL-MM-1a, CUL-MM-1c, and CUL-MM-1d would reduce this potentially significant effect, but not to a less-than-significant level because project implementation would still result in the damage or destruction of NRHP-eligible properties. Therefore, this effect is **significant and unavoidable**.

EFFECT CUL-3	Disturbance to Archaeological Remains as a Result of Compaction, Inundation, Wave-Induced Erosion, or Habitat Development and Management. *Because the value of archaeological resources often depends on their integrity, project activities that disturb buried resources could change their status under the NRHP. This effect is potentially significant.*

This effect and mitigation measure are the same as described under Alternatives 1 and 2, with the exception that under Alternative 3 it applies only to the resources listed below. Because the value of archaeological resources often depends on their integrity, project activities that disturb buried resources could render them ineligible which would be an adverse effect under NEPA. Implementation of Alternative 3 may result in the physical destruction of buried archaeological sites; therefore, this effect is **potentially significant**.

Affected Resources

- Buried archaeological remains on Webb Tract
- CA-SJO-208H on Bouldin Island
- CA-SJO-210H on Bouldin Island
- CA-CCO-147 on Holland Tract
- Buried archaeological remains on Holland Tract

Mitigation Measure: Implement Mitigation Measure CUL-MM-1 (Prepare and Implement a Historic Properties Treatment Plan).

The project applicant will ensure the HPTP includes the following components:

Mitigation Measure: Implement Mitigation Measure CUL-MM-1b (Prepare and Implement an Archaeological Resources Data Recovery Plan).

Mitigation Measure: Implement Mitigation Measure CUL-MM-1e (Provide Methods and Guidance for Subsurface Testing in the Form of Remote Sensing and Excavation).

Mitigation Measure: Implement Mitigation Measure CUL-MM-1g (Negotiate, Prepare, and Implement a Preburial Agreement with the Most Likely Descendant [as Determined by the Native American Heritage Commission] of Potential Native American Interments Located in Webb Tract).

Mitigation Measure CUL-MM-1h: Prepare and Implement an Archaeological Resources Data Recovery Plan for Site-Specific Resources.

This plan will specify how "significant" (as that term is defined under NEPA) archaeological data will be identified; recovered from sites CA-SJO-208H, CA-SJO-210H, and CA-CCO-147; analyzed; and reported to professionals and the public.

Implementing Mitigation Measures CUL-MM-1b, CUL-MM-1e, CUL-MM-1g, and CUL-MM-1h would reduce this effect to a **less-than-significant** level because a Historic Properties Treatment Plan would be prepared and implemented.

EFFECT CUL-4 Disturbance to Human Remains as a Result of Compaction, Inundation, Wave-Induced Erosion, Habitat Development and Management, or Vandalism. *Ground-disturbing activities could uncover previously undiscovered human burials within the project area. This effect is potentially significant.*

This effect is the same as described for Alternatives 1 and 2, except that under Alternative 3 it applies only to the resources listed below. Ground-disturbing activities could uncover previously undiscovered burials within the project APE. Implementation of Alternative 3 could result in disturbance of intact human burials as a result of project-related construction activities; therefore, this effect is **potentially significant**.

Affected Resources

- Buried archaeological resources (Webb Tract)
- Buried archaeological resources (Holland Tract)
- CA-CCO-593 (Holland Tract)
- CA-CCO-147 (Holland Tract)
- CA-CCO-678 (Holland Tract)

Mitigation Measure: Implement Mitigation Measure CUL-MM-1 (Prepare and Implement a Historic Properties Treatment Plan).

The project applicant will ensure the HPTP includes the following components:

Mitigation Measure: Implement Mitigation Measure CUL-MM-1b (Prepare and Implement an Archaeological Resources Data Recovery Plan).

Mitigation Measure: Implement Mitigation Measure CUL-MM-1e (Provide Methods and Guidance for Subsurface Testing in the Form of Remote Sensing and Excavation).

Mitigation Measure: Implement Mitigation Measure CUL-MM-1g (Negotiate, Prepare, and Implement a Preburial Agreement with the Most Likely Descendant [as Determined by the Native American Heritage Commission] of Potential Native American Interments Located in Webb Tract).

Mitigation Measure: Implement Mitigation Measure CUL-MM-1h (Prepare and Implement an Archaeological Resources Data Recovery Plan for Site-Specific Resources).

Implementing Mitigation Measures CUL-MM-1b, CUL-MM-1e, CUL-MM-1g and CUL-MM1h would reduce this potentially significant effect, but not to a less-than-significant level because unlike Alternatives 1 and 2, the level of potential ground disturbance under Alternative 3 would be great enough that it could uncover previously undiscovered burials. Therefore, this effect is **significant and unavoidable**.

Table 3.7-3
Comparison of Delta Wetlands Project 2001 FEIS and this SEIS Effects and Mitigation Measures for Cultural Resources

2001 FEIS Effects and Mitigation Measures	SEIS Effects and Mitigation Measures
Alternatives 1 and 2 (Proposed Action)	
Impact M-5: Demolition of the NRHP-Eligible Historic District on Bacon Island (SU) **Mitigation Measure M-5:** Prepare an HPMP and a Data Recovery Plan for Archaeological Deposits on Bacon Island **Mitigation Measure M-6:** Prepare a Videotape of Public Broadcasting System Quality of the NRHP-Eligible Historic District on Bacon Island **Mitigation Measure M-7:** Prepare a Popular Publication on Bacon Island Resources for Use by Museums, Cultural Centers, and Schools **Mitigation Measure M-8:** Complete Historic American Building Survey/Historic American Engineering Record Forms, Including Photographic Documentation, That Preserve Information about the NRHP-Eligible District on Bacon Island	**Effect CUL-1:** Destruction of Historic Buildings and Structures on Bacon Island and Bouldin Island (SU) **Mitigation Measure CUL-MM-1:** Prepare and Implement a Historic Properties Treatment Plan The HPTP will include the following components: **Mitigation Measure CUL-MM-1a:** Complete Historic Research, Measured Drawings, and Photographic Documentation of the NRHP-Eligible Property **Mitigation Measure CUL-MM-1b:** Prepare and Implement an Archaeological Resources Data Recovery Plan **Mitigation Measure CUL-MM-1c:** Produce a Publication to Disseminate Historical Information Regarding the NRHP-Eligible Property to the Public **Mitigation Measure CUL-MM-1d:** Prepare a Video That Disseminates Historical Information and Explains the Character-Defining Features of the NRHP-Eligible Property to the Public
Not previously evaluated	**Effect CUL-2:** Destruction of Levees and Unevaluated Built Environment Resources (SU) **Mitigation Measure CUL-MM-2:** Inventory and Evaluate Built Environment Resources **Mitigation Measure CUL-MM-1:** Prepare and Implement a Historic Properties Treatment Plan The HPTP will include the following components: **Mitigation Measure CUL-MM-1a:** Complete Historic Research, Measured Drawings, and Photographic Documentation for NRHP-Eligible Properties **Mitigation Measure CUL-MM-1c:** Produce a Publication

Table 3.7-3 **Comparison of Delta Wetlands Project 2001 FEIS and this SEIS Effects and Mitigation Measures for Cultural Resources**	
2001 FEIS Effects and Mitigation Measures	SEIS Effects and Mitigation Measures
	to Disseminate Historical Information Regarding the NRHP-Eligible Properties to the Public **Mitigation Measure CUL-MM-1d:** Prepare a Video That Disseminates Historical Information and Explains the Character-Defining Features of the NRHP-Eligible Properties to the Public
Impact M-1: Disturbance of Buried Resources (If Present) in the Archaeologically Sensitive Piper Sands on Webb Tract (LTS-M) **Mitigation Measure M-1:** Prepare an HPMP to Provide for the Long-Term Monitoring and Treatment of Archaeologically Sensitive Areas on Webb Tract	**Effect CUL-3:** Disturbance to Archaeological Remains as a Result of Compaction, Inundation, Wave-Induced Erosion, or Habitat Development and Management (LTS-M) **Mitigation Measure CUL-MM-1:** Prepare and Implement a Historic Properties Treatment Plan The HPTP will include the following components: **Mitigation Measure CUL-MM-1b:** Prepare and Implement an Archaeological Resources Data Recovery Plan (if necessary) **Mitigation Measure CUL-MM-1e:** Provide Methods and Guidance for Subsurface Testing in the Form of Remote Sensing and Excavation **Mitigation Measure CUL-MM-1f:** Steps to Implement for the Discovery of Cultural Resources
Impact M-3: Disturbance of Intact Burials in CA-CCo-593 (If Present) Resulting from Vandalism on Holland Tract (LTS-M) **Mitigation Measure M-3:** Prepare an HPMP to Address Disturbance of Human Remains at CA-CCo-593 on Holland Tract	Evaluated as part of Effect CUL-3
Impact M-4: Disturbance of Buried Resources (If Present) in the Archaeologically Sensitive Piper Sands on Holland Tract (LTS-M) **Mitigation Measure M-4:** Prepare an HPMP to Provide for the Long-Term Monitoring and Treatment of Archaeologically Sensitive Areas on Holland Tract	Evaluated as part of Effect CUL-3
Impact M-6: Disturbance of Archaeological Site CA-SJo-208H on Bouldin Island (LTS-M) **Mitigation Measure M-9:** Prepare an HPMP and a Data Recovery Plan for Archaeological Deposits on Bouldin Island	Evaluated as part of Effect CUL-3
Impact M-2: Disturbance of Intact Burials at CA-CCo-593 (If Present) on Holland Tract (LTS-M) **Mitigation Measure M-2:** Design Habitat Management and Enhancement Activities to Prevent Disturbance of CA-CCo-593 on Holland Tract	**Effect CUL-4:** Disturbance to Human Remains from Compaction as a Result of Inundation, Wave-Induced Erosion, Habitat Development and Management, or Vandalism (LTS-M) **Mitigation Measure CUL-MM-1:** Prepare and Implement a Historic Properties Treatment Plan The HPTP will include the following components: **Mitigation Measure CUL-MM-1b:** Prepare and Implement

Table 3.7-3
Comparison of Delta Wetlands Project 2001 FEIS and this SEIS Effects and Mitigation Measures for Cultural Resources

2001 FEIS Effects and Mitigation Measures	SEIS Effects and Mitigation Measures
	an Archaeological Resources Data Recovery Plan **Mitigation Measure CUL-MM-1e:** Provide Methods and Guidance for Subsurface Testing in the Form of Remote Sensing and Excavation **Mitigation Measure CUL-MM-1g**: Negotiate, Prepare, and Implement a Preburial Agreement with the Most Likely Descendant (as Determined by the Native American Heritage Commission) of Potential Native American Interments Located in Webb Tract
Alternative 3	
Impact M-11: Demolition of the CRHR-Eligible Historic District on Bacon Island (SU) **Mitigation Measure M-5:** Prepare an HPMP and a Data Recovery Plan for Archaeological Deposits on Bacon Island **Mitigation Measure M-6:** Prepare a Videotape of Public Broadcasting System Quality of the NRHP-Eligible Historic District on Bacon Island **Mitigation Measure M-7:** Prepare a Popular Publication on Bacon Island Resources for Use by Museums, Cultural Centers, and Schools **Mitigation Measure M-8:** Complete Historic American Building Survey/Historic American Engineering Record Forms, Including Photographic Documentation, That Preserve Information about the NRHP-Eligible District on Bacon Island	**Effect CUL-1:** Destruction of Historic Buildings and Structures on Bacon Island and Bouldin Island (SU) **Mitigation Measure CUL-MM-1:** Prepare and Implement a Historic Properties Treatment Plan The HPTP will include the following components: **Mitigation Measure CUL-MM-1a:** Complete Historic Research, Measured Drawings, and Photographic Documentation of NRHP-Eligible Properties **Mitigation Measure CUL-MM-1b:** Prepare and Implement an Archaeological Resources Data Recovery Plan **Mitigation Measure CUL-MM-1c:** Produce a Publication to Disseminate Historical Information NRHP-Eligible Properties to the Public **Mitigation Measure CUL-MM-1d:** Prepare a Video That Disseminates Historical Information and Explains the Character-Defining Features of NRHP-Eligible Properties to the Public
Not previously evaluated	**Effect CUL-2:** Destruction of Levees and Unevaluated Built Environment Resources (SU) **Mitigation Measure CUL-MM-2:** Inventory and Evaluate Built Environment Resources **Mitigation Measure CUL-MM-1:** Prepare and Implement a Historic Properties Treatment Plan The HPTP will include the following components: **Mitigation Measure CUL-MM-1a:** Complete Historic Research, Measured Drawings, and Photographic Documentation for NRHP-Eligible Properties **Mitigation Measure CUL-MM-1c:** Produce a Publication to Disseminate Historical Information Regarding the NRHP-Eligible Properties to the Public **Mitigation Measure CUL-MM-1d:** Prepare a Video That Disseminates Historical Information and Explains the Character-Defining Features of the NRHP-Eligible Properties to the Public
Impact M-7: Disturbance of Buried Resources (If Present) in the Archaeologically Sensitive Piper Sands on	**Effect CUL-3:** Disturbance to Archaeological Remains as a Result of Compaction, Inundation, Wave-Induced Erosion, or

Table 3.7-3
Comparison of Delta Wetlands Project 2001 FEIS and this SEIS Effects and Mitigation Measures for Cultural Resources

2001 FEIS Effects and Mitigation Measures	SEIS Effects and Mitigation Measures
Webb Tract (LTS-M) **Mitigation Measure M-1:** Prepare an HPMP to Provide for the Long-Term Monitoring and Treatment of Archaeologically Sensitive Areas on Webb Tract.	Habitat Development and Management (LTS-M) **Mitigation Measure CUL-MM-1:** Prepare and Implement a Historic Properties Treatment Plan The HPTP will include the following components: **Mitigation Measure CUL-MM-1e:** Provide Methods and Guidance for Subsurface Testing in the Form of Remote Sensing and Excavation **Mitigation Measure CUL-MM-1g:** Negotiate, Prepare, and Implement a Preburial Agreement with the Most Likely Descendant (as Determined by the Native American Heritage Commission) of Potential Native American Interments Located in Webb Tract **Mitigation Measure CUL-MM-1h:** Prepare and Implement an Archaeological Resources Data Recovery Plan for Site-Specific Resources
Impact M-8: Damage or Destruction of Known Archaeological Sites Resulting from Inundation, Wave Action and Erosion, or Vandalism on Holland Tract (SU) **Mitigation Measure M-10:** Prepare an HPMP and Conduct Data Recovery Excavations (Only Appropriate for CA-CCo-147) for Archaeological Materials on Holland Tract **Mitigation Measure M-11:** Cap Archaeological Sites on Holland Tract **Mitigation Measure M-12:** Construct Fencing or Other Barriers to Prevent Site Access on Holland Tract **Mitigation Measure M-13:** Construct Levees or Beach Slopes around Archaeological Sites to Decrease Wave Action and Erosion on Holland Tract **Mitigation Measure M-14:** Prepare an HPMP to Provide for the Long-Term Monitoring of Known Archaeological Sites on Holland Tract	Evaluated under Effect CUL-3
Impact M-9: Disturbance of Buried Resources (If Present) in the Archaeologically Sensitive Piper Sands on Holland Tract (LTS-M) **Mitigation Measure M-4:** Prepare an HPMP to Provide for the Long-Term Monitoring and Treatment of Archaeologically Sensitive Areas on Holland Tract	Evaluated under Effect CUL-3
Impact M-10: Disturbance of Unknown Resources on Unsurveyed Portions of Holland Tract (LTS-M) **Mitigation Measure M-15:** Survey Unsurveyed Portions of Holland Tract and Determine Eligibility for NRHP Listing and Appropriate Treatment	Evaluated under Effect CUL-3
Impact M-12: Disturbance of Archaeological Site CA-SJO-208H on Bouldin Island (LTS)	Evaluated under Effect CUL-3

Table 3.7-3 Comparison of Delta Wetlands Project 2001 FEIS and this SEIS Effects and Mitigation Measures for Cultural Resources	
2001 FEIS Effects and Mitigation Measures	SEIS Effects and Mitigation Measures
Mitigation Measure M-9: Prepare an HPMP and a Data Recovery Plan for Archaeological Deposits on Bouldin Island	
Not previously evaluated	**Effect CUL-4:** Disturbance to Human Remains from Compaction as a Result of Inundation, Wave-Induced Erosion, Habitat Development and Management, or Vandalism (SU) **Mitigation Measure CUL-MM-1:** Prepare and Implement a Historic Properties Treatment Plan The HPTP will include the following components: **Mitigation Measure CUL-MM-1b:** Prepare and Implement an Archaeological Resources Data Recovery Plan **Mitigation Measure CUL-MM-1e:** Provide Methods and Guidance for Subsurface Testing in the Form of Remote Sensing and Excavation **Mitigation Measure CUL-MM-1g:** Negotiate, Prepare, and Implement a Preburial Agreement with the Most Likely Descendant (as Determined by the Native American Heritage Commission) of Potential Native American Interments Located in Webb Tract **Mitigation Measure CUL-MM-1h:** Prepare and Implement an Archaeological Resources Data Recovery Plan for Site-Specific Resources

Notes: Shading denotes changes in the effect, significance conclusion, or mitigation measure from the 2001 FEIS; LTS = Less than significant; LTS-M = Less than significant with mitigation; SU = Significant and unavoidable

Source: Data compiled by AECOM in 2013

3.7.6 Secondary and Cumulative Effects

Secondary and cumulative effects on cultural resources resulting from implementing the project were described in the 2001 FEIS (Chapter 3M) and 2010 DEIR (Chapter 5). The 2001 FEIS and 2010 DEIR are herein incorporated by reference, and the effect conclusions and mitigation measures, along with any changes, are summarized briefly below and shown in Table 3.7-3.

Destruction of or Damage to Prehistoric Archaeological Sites in the Delta

Fourteen prehistoric sites have been found near the project APE. Many of these have been adversely affected by past agricultural activities, leveling, and sand extraction occurring in the Delta. Project-related activities would not contribute to the overall loss of prehistoric resources in the Delta because the single prehistoric archaeological site within the project APE is not eligible for listing in the NRHP. Therefore, the project's contribution to this cumulative effect is not cumulatively considerable.

Destruction of or Damage to NRHP-Eligible Properties and Historic Districts

During the last 25 years, many NRHP-eligible properties including the majority of agricultural labor camps in the Delta have been demolished or modified or have deteriorated without being documented or otherwise preserved. These resources represent the last vestiges of a once thriving agricultural period in the Delta. In addition, Bacon

Island is one of the last intact agricultural labor camp systems in the Delta. The destruction of the NRHP-eligible resources including Bacon Island Rural Historic District would add to the loss of these historic resource types in the Delta. Thus, project implementation would contribute to the overall loss of resources in the Delta and would result in a cumulatively considerable contribution to this cumulatively significant effect.

Mitigation Measure: Implement Mitigation Measure CUL-MM-1 (Prepare and Implement a Historic Properties Treatment Plan).

In accordance with the PA, the project applicant will ensure the HPTP includes the following components:

Mitigation Measure: Implement Mitigation Measure CUL-MM-1a (Complete Historic Research, Measured Drawings, and Photographic Documentation of the Bacon Island Rural Historic District NRHP-Eligible Property).

Mitigation Measure: Implement Mitigation Measure CUL-MM-1c (Produce a Publication to Disseminate Historical Information regarding the Bacon Island Rural Historic District NRHP-Eligible Property to the Public).

Mitigation Measure: Implement Mitigation Measure CUL-MM-1d (Prepare a Video That Disseminates Historical Information and Explains the Character-Defining Features of the Bacon Island Rural Historic District NRHP-Eligible Property to the Public).

Implementation of Mitigation Measures CUL-MM-1a through CUL-MM-1d would reduce the project's contribution to this effect, but not to a level that is less-than-cumulatively considerable because project implementation would still result in the destruction of NRHP-eligible properties and historic districts. Therefore, this effect is cumulatively significant and unavoidable.

Table 3.7-4
Comparison of Secondary and Cumulative Cultural Resources Effects between the 2001 FEIS and this SEIS

2001 FEIS Cumulative Effects and Mitigation Measures	SEIS Cumulative Effects and Mitigation Measures
Impact M-13: Destruction of or Damage to Prehistoric Archaeological Sites in the Delta (Alternatives 1 and 2) (NCC) **Mitigation:** No mitigation is required.	Destruction of or Damage to Prehistoric Archaeological Sites in the Delta (NCC) **Mitigation:** No mitigation is required. No change.
Impact M-14: Destruction of or Damage to the NRHP-Eligible Historic Districts Representing Agricultural Labor Camp Systems in the Delta (Alternatives 1 and 2) (CCU) (**Mitigation Measure M-5:** Prepare an HPMP and a Data Recovery Plan for Archaeological Deposits on Bacon Island **Mitigation Measure M-6:** Prepare a Videotape of Public Broadcasting System Quality of the NRHP-Eligible Historic District on Bacon Island **Mitigation Measure M-7:** Prepare a Popular Publication on Bacon Island Resources for Use by Museums, Cultural Centers, and Schools **Mitigation Measure M-8:** Complete Historic American Building Survey/Historic American Engineering Record Forms, Including Photographic Documentation, That Preserve Information about the NRHP-Eligible District on	Destruction of or Damage to NRHP-Eligible Properties and Historic Districts (CCU) **Mitigation Measure CUL-MM-1:** Prepare and Implement a Historic Properties Treatment Plan The HPTP will include the following components: **Mitigation Measure CUL-MM-1a:** Complete Historic Research, Measured Drawings, and Photographic Documentation for NRHP-Eligible Properties **Mitigation Measure CUL-MM-1c:** Produce a Publication to Disseminate Historical Information Regarding the NRHP-Eligible Properties to the Public **Mitigation Measure CUL-MM-1d:** Prepare a Video That Disseminates Historical Information and Explains the Character-Defining Features of the NRHP-Eligible Properties to the Public

Table 3.7-4
Comparison of Secondary and Cumulative Cultural Resources Effects between the 2001 FEIS and this SEIS

2001 FEIS Cumulative Effects and Mitigation Measures	SEIS Cumulative Effects and Mitigation Measures
Bacon Island	
Impact M-15: Destruction of or Damage to Prehistoric Archaeological Sites in the Delta (Alternative 3) (CCU) **Mitigation Measure M-4:** Prepare an HPMP to Provide for the Long-Term Monitoring and Treatment of Archaeologically Sensitive Areas on Holland Tract **Mitigation Measure M-11:** Cap Archaeological Sites on Holland Tract **Mitigation Measure M-12:** Construct Fencing or Other Barriers to Prevent Site Access on Holland Tract **Mitigation Measure M-13:** Construct Levees or Beach Slopes around Archaeological Sites to Decrease Wave Action and Erosion on Holland Tract **Mitigation Measure M-14:** Prepare an HPMP to Provide for the Long-Term Monitoring of Known Archaeological Sites on Holland Tract **Mitigation Measure M-15:** Survey Unsurveyed Portions of Holland Tract and Determine Eligibility for NRHP Listing and Appropriate Treatment	All three alternatives are evaluated together. See Destruction of or Damage to Prehistoric Archaeological Sites in the Delta (NCC), above.
Impact M-16: Destruction of or Damage to the NRHP-Eligible Historic Districts Representing Agricultural Labor Camp Systems in the Delta (Alternative 3) (CCU) **Mitigation Measure M-5:** Prepare an HPMP and a Data Recovery Plan for Archaeological Deposits on Bacon Island **Mitigation Measure M-6:** Prepare a Videotape of Public Broadcasting System Quality of the NRHP-Eligible Historic District on Bacon Island **Mitigation Measure M-7:** Prepare a Popular Publication on Bacon Island Resources for Use by Museums, Cultural Centers, and Schools **Mitigation Measure M-8:** Complete Historic American Building Survey/Historic American Engineering Record Forms, Including Photographic Documentation, That Preserve Information about the NRHP-Eligible District on Bacon Island	All three alternatives are evaluated together. See Destruction of or Damage to NRHP-Eligible Properties and Historic Districts (CCU), above.

Notes: Shading denotes changes in the effect, significance conclusion, or mitigation measure from the 2001 FEIS; NCC = Not cumulatively considerable; CCU = Cumulatively considerable and unavoidable

Source: Data compiled by AECOM in 2013

3.8 ENVIRONMENTAL JUSTICE

3.8.1 INTRODUCTION

Under NEPA, an analysis of Federal actions that have the potential to result in disproportionately high and adverse effects on minority and low-income populations is required pursuant to Executive Order (EO) 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* (59 Federal Register 8 [FR] 7629). Under EO 12898, demographic information is used to determine whether minority populations or low-income populations are present in the areas potentially affected by the project. If so, a determination must be made as to whether implementation of the project may cause disproportionately high and adverse human health or environmental effects on those populations.

Because the 2001 FEIS did not include a section related to Environmental Justice, this section of the SEIS is entirely new. This section describes the potentially affected environmental justice populations, as well as potential environmental consequences and associated mitigation measures (if necessary), as they pertain to implementing the Proposed Action and alternatives under consideration. Section 3.16, "Socioeconomics," analyzes effects on social and economic characteristics and the balance of population, employment, and housing.

3.8.2 AFFECTED ENVIRONMENT

The affected environment for environmental justice includes discussion of race, ethnic origin, and economic status of affected groups. For purposes of this analysis, the definitions of minority individuals and minority and low-income populations was provided in the Council on Environmental Quality's (CEQ's) *Environmental Justice: Guidance under the National Environmental Policy Act* (Council on Environmental Quality 1997). Substantial concentrations of minority or low-income individuals are sometimes referred to as environmental justice populations. Historically, minority and low-income populations have suffered a greater share of the adverse environmental and health effects of industry and development relative to the benefits.

A minority population is present within a study area under either of the following conditions:

- The minority population percentage of the study area is meaningfully greater than the affected area's general population.
- The minority population percentage of the affected area exceeds 50%.

The CEQ defines minority individuals as persons from any of the following U.S. Census categories for race: Black/African American, Asian, Native Hawaiian or Other Pacific Islander, and American Indian or Alaska Native. Additionally, for the purposes of this analysis, minority individuals also include all other nonwhite racial categories that were added in the most recent census, such as "some other race" and "two or more races." The CEQ also mandates that persons identified through the U.S. Census as ethnically Hispanic, regardless of race, should be included in minority counts (Council on Environmental Quality 1997:25).

Low-income populations are identified based upon statistical poverty thresholds established by the U.S. Census Bureau and are identified in one of the following ways (Council on Environmental Quality 1997:25):

- The population percentage below the poverty level is meaningfully greater than that of the population percentage in the general population.
- The population percentage below the poverty level in the affected area exceeds 50%.

PROJECT ISLANDS

The “affected area” for identifying environmental justice effects from construction and operation at the four project islands was determined to be areas that could be affected by construction of discharge and diversion facilities and levee improvements; water storage operations; and implementation of a Compensatory Mitigation Plan (CMP). To characterize this area, the environmental justice setting data represents the geographic extent in which project-specific effects on proximate and adjacent minority and low-income populations could occur. Webb Tract and Holland Tract are contained within U.S. Census Bureau Census Tract (CT) 3010 in Contra Costa County. Bacon Island and Bouldin Island are located in CTs 39 and 40.01, respectively, in San Joaquin County. By evaluating CTs 3010, 39, and 40.01, the environmental justice analysis focuses on the smallest geographic area where U.S. Census data is available and has been applied to assess the effects specific to the populations in the vicinity of the project islands. In addition, to provide a basis for comparison of the localized study areas, environmental justice demographic data is also provided for Contra Costa and San Joaquin Counties and the State of California.

CTs 3010, 39, and 40.01 are located in a rural, unincorporated area of the Sacramento-San Joaquin Delta (Delta) that primarily consists of agricultural lands and tidal water channels. The majority of the population within the affected area resides in the Bethel Island Census Designated Place (CDP) within CT 3010 and the Terminous and Thornton CDPs in CT 40.01. CDPs are delineated to provide data for settled concentrations of population that are identifiable by name but, like the communities of Bethel Island, Terminous, and Thornton, are not incorporated. Approximately 58% of the population within CT 3010 is located within the Bethel Island CDP and 68% of the population within CT 40.01 is located within the Terminous and Thornton CDPs. There are no CDPs within CT 39.

Minority Populations

Table 3.8-1 presents racial and ethnic characteristics for CTs 3010, 39, and 40.01; the Bethel Island, Terminous, and Thornton CDPs; Contra Costa and San Joaquin Counties; and the state. These data are from the 2010 decennial census, as the 2010 census is the most recently completed dataset that provides racial and ethnic heritage data at the local, countywide, and statewide level.

As shown in Table 3.8-1, no minority populations in CT 3010 and the Bethel Island CDP are greater than 50% of the population or are proportionally larger than Contra Costa County or the state. The proportion of individuals identifying themselves as White in CT 3010 and the Bethel Island CDP (79.1% and 86.2%, respectively) was greater than Contra Costa County (58.6%) and the state as a whole (57.6%). The proportions of residents responding as being American Indian, Asian, and Pacific Islander within CT 3010 and the Bethel Island CDP are generally consistent with Contra Costa County and the state, while the proportions of residents responding as African-American, Asian, “some other race,” and “two or more races” are substantially less than the county and the state. People identifying themselves as Hispanic represented the largest non-white group in CT 3010 and the Bethel Island CDP, accounting for approximately 16.3% and 13.1%, respectively, of the total population. However, these percentages are substantially lower than the county (24.2%) and the state population (37.6%) identified as Hispanic.

The proportion of individuals identifying themselves as White in CT 39, CT 40.01, and the Terminous CDP (57.3%, 58.9%, and 88.7%, respectively) was greater than San Joaquin County (51.0%) and similar to the state (57.6%) while the proportion of individuals identifying themselves as White in in the Thornton CDP (49.0%) was less than the county and state. The proportions of individuals responding as being African-American, American Indian, Asian, and “some other race” were substantially less than the county’s and the state’s populations. However, the proportions of individuals responding as “two or more races” in CTs 39 and 40.01 and the Thornton CDP (37.9%, 30.7%, and 39.2%, respectively) are substantially higher than in the county or the state (6.4% and 4.9%, respectively). The Hispanic population represented the largest non-white population within CTs 39 and 40.01 (72.6% and 53.0%, respectively) and the Thornton CDP (68.1%). These percentages are substantially greater than the average county (38.9%) and the average state population (37.6%) identified as Hispanic. Therefore, the Hispanic population in CTs 39 and 40.01 and the Thornton CDP exceeds 50% and is proportionally larger than the population in the county or the state.

Table 3.8-1 Racial Composition and Ethnicity Percentages in the Affected Area, 2010								
Geographic Area	White	Black/ African American	American Indian and Alaska Native	Asian	Native Hawaiian/ Pacific Islander	Some Other Race	Two or More Races	Hispanic (any race)
CT 3010 [1]	79.1	4.8	0.9	4.4	0.2	6.0	4.6	16.3
CT 39 [2]	57.3	0.5	1.8	0.6	0.0	37.9	1.9	72.6
CT 40.01 [3]	58.9	2.2	0.6	3.7	0.2	30.7	3.6	53.0
Contra Costa County	58.6	9.3	0.6	14.4	0.5	10.7	5.9	24.4
Bethel Island CDP [4]	86.2	1.9	0.7	2.2	0.2	5.6	3.3	13.1
San Joaquin County	51.0	7.6	1.1	14.4	0.5	19.1	6.4	38.9
Terminous CDP [5]	88.7	0.5	1.6	1.8	0	3.4	3.9	10.5
Thornton CDP [5]	49.0	3.8	0.3	4.0	0.1	39.2	3.7	68.1
State of California	57.6	6.2	1.0	13.0	1.0	17.0	4.9	37.6

Notes: CDP = Census Designated Place

[1] CT 3010 is located within Contra Costa County and includes the Holland and Webb Tracts.
[2] CT 39 is located in San Joaquin County and includes Bacon Island.
[3] CT 40.01 is located in San Joaquin County and includes Bouldin Island.
[4] The Bethel Island CDP is located within CT 3010.
[5] The Terminous and Thornton CDPs are located within CT 40.01.

Source: U.S. Census Bureau 2010a

Low-Income Populations

Table 3.8-2 presents the median household income, per capita income, and proportion of individuals living below the poverty threshold for CTs 3010, 39, and 40.01; the Bethel Island, Terminous, and Thornton CDPs; Contra Costa and San Joaquin Counties; and the State of California. Data in Table 3.8-2 were obtained from the U.S. Census Bureau 2007-2011 American Community Survey (ACS). Estimates from the ACS are all "period" estimates that represent data collected over a period of time (as opposed to "point-in-time" estimates, such as the decennial census, that approximate the characteristics of an area on a specific date). The primary advantage of using multiyear estimates in this analysis of low-income populations is the increased statistical reliability of the data for less populated areas and small population subgroups.

Persons living with income below the poverty level are identified as "low-income" according to the annual statistical poverty thresholds established by the U.S. Census Bureau. Income thresholds vary by family size and composition to determine which families are living in poverty. Poverty thresholds do not vary geographically but are updated annually for inflation using the Consumer Price Index. According to the U.S. Census Bureau, the poverty threshold in 2011 was $11,484 for an individual and $22,891 for a family of four (U.S. Census Bureau 2011b). The median household income in CTs 3010, 39, and 40.01; the Bethel Island, Terminous, and Thornton CDPs; and Contra Costa and San Joaquin Counties is greater than the poverty threshold (Table 3.8-2).

Contra Costa County's median household income ($79,135) and per capita income ($38,144) is higher than the statewide median household income ($60,632) and per capita income ($29,674). San Joaquin County's median household income ($53,764) and per capita income ($22,857) is less than the state's median household ($60,632) income and the per capita income ($29,674). The percentage of populations of Contra Costa County at income levels below the poverty threshold (9.9%) were less than the statewide average of 14.4%. San Joaquin County had a greater population below the poverty rate (16.7%) than the state.

Table 3.8-2
Median Household Income, Per Capita Income, and Poverty Levels for the Affected Area, 2011

Geographic Area	Median Income	Per Capita Income	Percent of Population Below Poverty Level
CT 3010 [1]	$37,972	$27,520	18.9
CT 39 [2]	$34,569	$20,165	30.3
CT 40.01 [3]	$42,375	$21,663	13.8
Contra Costa County	$79,135	$38,144	9.9
Bethel Island CDP	$30,409	$27,433	16.5
San Joaquin County	$53,764	$22,857	16.7
Terminous CDP	$57,500	$44,594	1.9
Thornton CDP	$46,250	$15,438	26.8
State of California	$60,632	$29,674	14.4

Notes: CDP = Census Designated Place

[1] CT 3010 is located within Contra Costa County and includes Holland and Webb Tracts and the Bethel Island CDP.

[2] CT 39 is located in San Joaquin County and includes Bacon Island.

[3] CT 40.01 is located in San Joaquin County and includes Bouldin Island and the Terminous and Thornton CDPs.

Source: U.S. Census Bureau 2011a

CT 3010 and the Bethel Island CDP, both of which are within Contra Costa County, had median household incomes ($37,972 and $30,409, respectively) and per capita incomes ($27,520 and $27,433, respectively) that were less than the county's median household ($79,135) income and the per capita income ($38,144) but greater than the statewide median household ($60,632) income and the per capita income ($29,674). CT 3010 had a greater population below the poverty rate (18.9%) than the county (9.9%) or the state (14.4%). The Bethel Island CDP had a greater population below the poverty rate (18.9%) than the county and the state.

CTs 39 and 40.01 and the Thornton CDP, all of which are within San Joaquin County, had median household incomes ($34,569, $42,375, and $46,250, respectively) and per capita incomes ($20,165, $21,663, and $15,438, respectively) that were substantially less than the county's median household ($53,764) income and the per capita income ($22,857) and statewide median household ($60,632) income and statewide per capita income ($29,674). The population below the poverty threshold in CTs 39 and 40.01 (18.9% and 30.3%, respectively) as well as Thornton CDP (26.8%) was greater than San Joaquin County (16.7%) and the state as a whole (14.4%). The Terminous CDP had a median household income ($57,500) that was greater than the San Joaquin County's average but less than the median household income of the state and the Terminous CDP had a population below the poverty threshold that was substantially less than the county or the state.

For the purposes of this analysis, areas where poverty levels are 50% greater than the state average of 14.4% (i.e., 28.8% or more of the population) would be considered meaningfully greater. Therefore, the percentage of the population below the poverty level in CT 39 (30.3%) is meaningfully greater than of the percentage of the general population in the state living in poverty.

PLACES OF USE

The specific places of use for project water consist of the following water districts:

- Semitropic Water Storage District (Semitropic) in Kern County;
- Metropolitan Water District of Southern California (Metropolitan) and the service areas of its member agencies in Kern, Los Angeles, Orange, Riverside, San Bernardino, San Diego, and Ventura Counties;
- Western Municipal Water District (Western) of Riverside County; and
- Golden State Water Company (Golden State) systems and communities in Los Angeles, Orange, San Luis Obispo, Santa Barbara, and Ventura Counties.

The project water would be used to improve water supply reliability for the Semitropic, Metropolitan, Western, and Golden State water users, which include irrigation, domestic, and municipal and industrial beneficial uses. The "affected area" for identifying environmental justice effects in the places of use was determined to be the counties within the Semitropic, Metropolitan, Western, and Golden State water districts that could receive project water. Thus, the environmental justice setting focuses on a nine-county area that includes Kern, Los Angeles, Orange, Riverside, San Bernardino, San Diego, San Luis Obispo, Santa Barbara, and Ventura Counties. Environmental justice demographic data is also provided for the State of California to provide a basis for comparison of the nine-county area to a larger reference area.

Minority Populations

Table 3.8-3 presents racial and ethnic characteristics for the nine-county area that comprises the places of use and the State of California. These data are from the 2010 decennial census, as the 2010 census is the most recently completed dataset that provides racial and ethnic heritage data at the countywide and statewide level.
Overall, the majority of people in the area are white, but the proportion of population identified as white varies substantially between counties in the area. The white population of San Luis Obispo County (82.6%) in 2010 was the highest proportion of any county in the area, while Los Angeles County had the lowest proportion of white residents (50.3%). Los Angeles (8.7%), Riverside (6.4%), and San Bernardino (8.9 %) Counties all registered a higher percentage of African-Americans than the state as a whole (6.2%). The Asian populations in Los Angeles (13.7%) and Orange (17.9%) Counties were higher than the state's population of Asians (13.0%). The proportions of residents responding as being American Indian and Pacific Islander are generally consistent with the statewide levels. The proportions of residents responding as "two or more races" in Kern (24.3%), Los Angles (21.8%), Riverside (20.5%), and San Bernardino (21.6%) Counties are substantially higher than the statewide levels (17.0%). In all of the counties, the Hispanic population represented the largest non-white population, ranging from 20.8% in San Luis Obispo County to 49.2% in Kern County. The percentage of the Hispanic population in Kern, Los Angeles, Riverside, San Bernardino, Santa Barbara, and Ventura Counties are higher than the average state population (37.6%) identified as Hispanic. No other sizeable variations in minority populations were observed between the state and county levels.

Low-Income Populations

Table 3.8-4 presents the median household income, per capita income, and proportion of individuals living below the poverty threshold for the nine-county area. Data in Table 3.8-4 were obtained from the U.S. Census Bureau 2007-2011 ACS.

As discussed above, the U.S. Census Bureau poverty threshold in 2011 was $11,484 for an individual and $22,891 for a family of four (U.S. Census Bureau 2011b). As shown in Table 3.8-4, the median household income in the places of use is greater than the poverty threshold.

Table 3.8-3 Racial Composition and Ethnicity Percentages in the Places of Use, 2010								
County	White	Black/ African American	American Indian and Alaska Native	Asian	Native Hawaiian/ Pacific Islander	Some Other Race	Two or More Races	Hispanic (any race)
Kern	59.5	5.8	1.5	4.2	0.1	24.3	4.5	49.2
Los Angeles	50.3	8.7	0.7	13.7	0.3	21.8	4.5	47.7
Orange	60.8	1.7	0.6	17.9	0.3	14.5	4.2	33.7
Riverside	61.0	6.4	1.1	6.0	0.3	20.5	4.8	45.5
San Bernardino	56.7	8.9	1.1	6.3	0.3	21.6	5.0	49.2
San Diego	64.4	5.1	0.9	10.9	0.5	13.6	5.1	32.0
San Luis Obispo	82.6	2.1	0.9	3.2	0.1	7.3	3.8	20.8
Santa Barbara	69.6	2.0	1.3	4.9	0.2	17.4	4.6	42.9
Ventura	68.7	1.8	1.0	6.7	0.2	17.0	4.5	40.3
State of California	57.6	6.2	1.0	13.0	1.0	17.0	4.9	37.6
Source: U.S. Census Bureau 2010b								

Table 3.8-4 Median Household Income, Per Capita Income, and Poverty Levels for the Places of Use, 2011			
Geographic Area	Median Income	Per Capita Income	Percent of Population Below Poverty Level
Kern	$48,021	$20,167	21.4
Los Angeles	$56,266	$27,954	16.3
Orange	$75,762	$34,416	10.9
Riverside	$58,365	$24,516	14.2
San Bernardino	$55,853	$21,932	16.0
San Diego	$63,857	$30,955	13.0
San Luis Obispo	$58,630	$30,204	13.2
Santa Barbara	$61,896	$30,330	14.2
Ventura	$76,728	$32,740	9.9
State of California	$60,632	$29,674	14.4
Source: U.S. Census Bureau 2011c			

As shown in Table 3.8-4, the median household income for Riverside, San Luis Obispo, and Santa Barbara Counties is similar to the statewide median household income ($60,632) while the median household income for Los Angeles and San Bernardino Counties is slightly less than the state. Kern County recorded the lowest median household income ($48,021), which averaged $12,600 less than the state's average. Ventura and Orange Counties exhibited median household incomes substantially higher than the state with Ventura County registering the highest median household income, approximately $76,700.

Per capita income in San Diego, San Luis, and Santa Barbara Counties is similar and higher than the state's per capita income ($29,674). Per capita income in Kern, Los Angeles, Riverside, and San Bernardino Counties was less than the state with Kern County recording the lowest per capita income ($20,167), which averaged $9,500 less than the state. Ventura and Orange Counties exhibited per capita incomes higher than the state with Orange County registering the highest per capita income ($34,400).

The population percentage in the study area below the poverty level does not exceed 50%. The population below the poverty threshold in the nine-county place of use area ranges from 9.9% in Ventura County to 21.4% in Kern County. Therefore, none of the counties within this study area have a proportion of low-income residents that would be considered meaningfully greater than that the state (28.8%).

3.8.3 Regulatory Framework/Applicable Laws, Regulations, Plans, and Policies

Federal

National Environmental Policy Act, Section 1502

Provisions in NEPA found in Section 1502.16(c) of the Code of Federal Regulations (CFR) (40 CFR 1502.16[c]) require Federal agencies to identify potential conflicts between a proposed action and the related plans and policies of Federal, state, and local agencies and Native American tribes. This requirement helps Federal agencies identify potential conflicts that may cause adverse effects on the social and economic environment of a study area because many agencies' and tribes' plans and policies are designed to protect the people residing within their jurisdictions and/or the local economy they depend upon for their economic livelihoods (NEPAnet 2008).

Council on Environmental Quality

The CEQ Regulations for Implementing the Procedural Provisions of NEPA (40 CFR 1500–1508) provide guidance related to social and economic impact assessments by noting that the "human environment" assessed under NEPA is to be "interpreted comprehensively" to include "the natural and physical environment and the relationship of people with that environment" (40 CFR 1508.14). Furthermore, these regulations require agencies to assess "aesthetic, historic, cultural, economic, social, or health" effects, whether direct, indirect, or cumulative (40 CFR 1508.8).

Executive Order 12898

In 1994, President Clinton issued Executive Order 12898 regarding environmental justice. This order requires Federal agencies to identify and address disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority populations and low-income populations in the United States. Two documents provide some measure of guidance to agencies required to implement this executive order: *Environmental Justice: Guidance under the National Environmental Policy Act* (CEQ 1997) and *Final Guidance for Incorporating Environmental Justice Concerns in EPA's NEPA Compliance Analysis* (U.S. Environmental Protection Agency [EPA] 1998). Both serve as guides for incorporating environmental justice goals into preparation of environmental impact statements under NEPA. These documents provide specific guidelines for determining whether there would be any environmental justice issues associated with a proposed Federal action.

State

There are no state laws, regulations, plans, or policies that would apply to the Proposed Action or alternatives under consideration.

3.8.4 Assessment Methodology

As discussed above, the affected area can be described in terms of U.S. Census Bureau CTs 3010, 39, and 40.01 and the Bethel Island CDP in CT 3010, and the Terminous and Thornton CDPs in CT 40.01, which together represent the geographic extent in which project-specific effects on proximate and adjacent populations to the four project islands could occur. In addition, data compiled for Contra Costa and San Joaquin Counties and the state allows for a comparison of the demographic characteristics of the affected area to a larger reference area. For the places of use, the affected area was determined to be the nine counties within the Semitropic, Metropolitan, Western, and Golden State Water Districts that could receive project water. Environmental justice demographic data is also provided for state to provide a basis for comparison of the nine-county area to a larger reference area.

According to CEQ and EPA guidelines, the first step in conducting an environmental justice analysis is to define minority and low-income populations. Based on these guidelines, a minority population is present if (1) the minority population of the affected area exceeds 50%, or (2) if the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis. By the same rule, a low-income population exists if (1) the population percentage below the poverty level in the affected area exceeds 50%, as defined by the U.S. Census Bureau, or (2) if the percentage of people living in households below the poverty threshold in the affected area is substantially greater than the poverty percentage of the general population or other appropriate unit of geographic analysis. For the purposes of this environmental justice screening, racial and ethnic characteristics were obtained from the U.S. Census Bureau 2010 decennial census, and income characteristics and poverty status were obtained from the U.S. Census Bureau 2007-2011 ACS.

The second step of an environmental justice analysis requires that a determination be made as to whether a “high and adverse” effect would occur. The CEQ guidance indicates that when determining whether the effects are high and adverse, agencies are to consider whether the risks or rates of effect “are significant (as that term is defined by the NEPA lead agency) or above generally accepted norms.”
The final step requires a determination as to whether the effect on the minority or low-income population would be “disproportionately high and adverse.” Although none of the published guidelines define the term “disproportionately high and adverse,” CEQ includes a non-quantitative definition stating that an effect is disproportionate if it appreciably exceeds the risk to the general population.

Identification of an area that is potentially affected by the project and contains a disproportionate amount of low-income or minority residents does not, by itself, constitute an environmental justice effect. Rather, an environmental justice effect would occur if the project would disproportionately affect a population that is made up of 50% or greater of either the minority or low-income categories. If the jurisdiction has a population of 50% or greater for either the minority or low-income categories or has a population meaningfully greater (50% or greater) than the minority or low-income population percentage in the general population of the regional area, it is identified for more detailed analysis.

Significance Criteria

To make a finding that disproportionately high and adverse effects would likely fall on a minority or low-income population, the following three conditions must be met simultaneously:

- a minority or low-income population must reside in the affected area,
- a high and adverse effect must exist, and
- the effect on the minority or low-income population must be disproportionately high and adverse.

For purposes of this NEPA analysis, the Proposed Action or alternatives under consideration would result in a significant effect if a disproportionately high and adverse effect would likely fall on a minority or low-income population.

3.8.5 Environmental Consequences and Mitigation Measures

Effects Analysis

Effects related to environmental justice resulting from implementation of the project were not previously described in the 2001 FEIS. The effects conclusions and mitigation measures are summarized in Table 3.8-5.

No-Action Alternative

EFFECT EJ-1 **Potential for Disproportionately High and Adverse Effects on Minority and Low-Income Populations in** CT 3010 and the Bethel Island and Terminous CDPs. *The increased intensity of agricultural operations and the for-fee hunting program that would be implemented under the No-Action Alternative would not result in substantial changes from existing conditions. Therefore, no disproportionately high and adverse effects on minority or low-income populations in CT 3010 or the Bethel Island or the Terminous CDPs would occur.*

The increased intensity of agricultural operations and the for-fee hunting program that would be implemented under the No-Action Alternative would not result in substantial changes from existing conditions. Therefore, **no disproportionately high and adverse effects** on minority or low-income populations in in CT 3010 or the Bethel Island or the Terminous CDPs would occur.

EFFECT EJ-2 **Potential for Disproportionately High and Adverse Effects on Minority and Low-Income Populations in** the Places of Use. *Under the No-Action Alternative, no water would be diverted onto the project islands for storage nor would it be exported to south-of-Delta groundwater banks or water districts for water supply. Therefore, no disproportionately high and adverse effects on minority or low-income populations in the places of use would occur.*

Under the No-Action Alternative, no water would be diverted onto the project islands for storage nor would it be exported to south-of-Delta groundwater banks or water districts for water supply. Therefore, **no disproportionately high and adverse effects** on minority or low-income populations in the places of use would occur.

EFFECT EJ-3 **Potential for Disproportionately High and Adverse Effects on Minority and Low-Income Populations in** CTs 39 and 40.01 and the Thornton Island CDP. *The increased intensity of agricultural operations and the for-fee hunting program that would be implemented under the No-Action Alternative would not result in substantial changes from existing conditions. Therefore, no disproportionately high and adverse effects on minority or low-income populations in the places of use would occur.*

The increased intensity of agricultural operations and the for-fee hunting program that would be implemented under the No-Action Alternative would not result in substantial changes from existing conditions. Therefore, **no disproportionately high and adverse effects** on minority or low-income populations in CTs39 and 40.01 or the Thornton CDP would occur.

Alternative 1 and Alternative 2 (Proposed Action)

The effects analysis and mitigation measures for Alternatives 1 and 2 are the same; therefore, they are described together under this heading.

EFFECT EJ-1 **Potential for Disproportionately High and Adverse Effects on Minority and Low-Income Populations in CT 3010 and the Bethel Island and the Terminous CDPs.** *There is no minority population recognized by the U.S. Census Bureau in CT 3010, the Bethel Island CDP, or the Terminous CDP that comprises greater than 50% of the population, nor are any of these minority populations proportionally larger than in the county or the state. In addition, the percentage of the population below the poverty level in CT 3010, the Bethel Island CDP, and the Terminous CDP does not exceed 50% and is not meaningfully greater than of the percentage of the general population in the state living in poverty. Therefore, no disproportionately high and adverse effects on minority or low-income populations in CT 3010, the Bethel Island CDP, or the Terminous CDP would occur.*

As shown in Table 3.8-1, the minority populations recognized by the U.S. Census Bureau in CT 3010 and the Bethel Island CDP (in Contra Costa County), and the Terminous CDP (in San Joaquin County), are not greater than 50% of the population and are not proportionally larger than in the county or the state. People identifying themselves as Hispanic represented the largest non-white group in CT 3010, the Bethel Island CDP, and the Terminous CDP, and they accounted for approximately 16.3%, 13.1%, and 10.5%, respectively, of the total population. However, these percentages are substantially lower than the average Contra Costa County population (24.2%), the average San Joaquin County population (38.9%), and the average state population (37.6%) identified as Hispanic. In addition, the percentage of the population below the poverty level in CT 3010 (18.9%), the Bethel Island CDP (16.5%), and the Terminous CDP (1.9%) does not exceed 50% and is not meaningfully greater than of the percentage of the general population in the state living in poverty (28.8%). Therefore, **no disproportionately high and adverse effects** on minority or low-income populations in CT 3010, the Bethel Island CDP, or the Terminous CDP would occur.

Mitigation Measure: No mitigation is required.

EFFECT EJ-2 **Potential for Disproportionately High and Adverse Effects on Minority and Low-Income Populations in the Places of Use.** *There is no minority population recognized by the U.S. Census Bureau in the nine-county place-of-use area that comprises greater than 50% of the population, nor is any minority population proportionally larger than in the state. In addition, the population percentage in the nine-county place-of-use area below the poverty level does not exceed 50% and is not meaningfully greater than of the percentage of the general population in the state living in poverty. Therefore, no disproportionately high and adverse effects on minority or low-income populations in the places of use would occur.*

As shown in Table 3.8-3, no minority populations recognized by the U.S. Census Bureau in the nine-county place-of-use area make up greater than 50% of the population nor are any of these populations proportionally larger than in the state as a whole. In addition, as shown in Table 3.8-4, the population percentage in the nine-county area below the poverty level does not exceed 50%. The population below the poverty threshold ranges from 9.9% in Ventura County to 21.4% in Kern County. Therefore, none of the counties within the places of use have a proportion of low-income populations that would be considered meaningfully greater than that of the state (i.e., greater than 28.8%). The project water would be used to improve water supply reliability for the current Semitropic, Metropolitan, Western, and Golden State water users, which include irrigation, domestic, and municipal and industrial beneficial uses. Therefore, **no disproportionately high and adverse effects** on minority or low-income populations in the places of use would occur.

Mitigation Measure: No mitigation is required.

EFFECT EJ-3 **Potential for Disproportionately High and Adverse Effects on Minority and Low-Income Populations in CTs 39 and 40.01 and the Thornton Island CDP.** *Minority populations in CTs 39 and 40.01 and the Thornton CDP are greater than 50%, and the percentage of low-income populations in CT 39 is meaningfully greater than the state as a whole; therefore, the project would result in disproportionately high and adverse effects on minority or low-income populations. This effect is significant.*

Based on CEQ and EPA guidelines, minority populations are present in CTs 39 and 40.01 and the Thornton Island CDP, and low-income populations are present in CT 39. The Hispanic population within CTs 39 and 40.01 (72.6% and 53.0%, respectively) and the Thornton CDP (68.1%) are greater than 50% and are substantially greater than the average San Joaquin County (38.9%) and the average state population (37.6%) identified as Hispanic. In addition, the percentage of the population below the poverty level in CT 39 (30.3%) is meaningfully greater than of the percentage of the general population in the state living in poverty (28.8%). Thus, there is a potential that project implementation could cause disproportionately high and adverse effects on minority populations in CTs 39 and 40.01 and the Thornton CDP, and on low-income populations in CT 39.

Aesthetics, agricultural resources, air quality, aquatic resources, cultural resources, land use, and socioeconomic effects that would be significant and unavoidable and, thus, could cause disproportionately high and adverse effects on minority populations in CTs 39 and 40.01 and the Thornton CDP and low-income populations in CT 39 are discussed below.

Aesthetics

Section 3.1, "Aesthetics," identifies the following significant, adverse effect on visual resources:

- Effect VIS-3: Reduction in the Quality of Views of Bacon Island and Webb Tract from Adjacent Waterways and from the Santa Fe Railways Amtrak Line.

Implementing Alternatives 1 and 2 could reduce the vividness, intactness, and visual quality of interior and exterior project island views by converting agricultural use to open water or shallow-water wetland vegetation; removing vegetation along project levees; and introducing rock revetment, pump stations, and siphon stations. Views from the Santa Fe Railways Amtrak line along the south side of Bacon Island would be similarly affected.

The following mitigation measures have been identified to reduce these effects, but no additional feasible mitigation measures are available that would fully reduce these effects to a less-than-significant level:

- Mitigation Measure VIS-MM-1: Partially Screen Proposed Pump and Siphon Stations from Important Viewing Areas.
- Mitigation Measure VIS-MM-2: Design Levee Improvements, Siphon and Pump Stations, and Maintenance Boat Docks to Be Consistent with the Surrounding Landscape.

CTs 39 and 40.01 and the Thornton CDP have a disproportionate minority population relative to San Joaquin County demographics and the state as a whole, and CT 39 has low-income populations. Changes in sensitive viewsheds could affect these populations. However, the reduced quality of views of Bacon Island and Webb Tract from adjacent waterways and of Bacon Island and from the Santa Fe Railways Amtrak line would affect all boaters and anglers that frequently use designated scenic waterways and passengers on the Amtrak line regardless of race, ethnicity, or income level. Therefore, **no disproportionately high and adverse effects** on minority populations in CTs 39 and 40.01 and the Thornton CDP or low-income populations in CT 39 related to aesthetics would occur.

Mitigation Measure: No mitigation is required.

Agricultural Resources

Section 3.2, "Agricultural Resources," identifies the following significant, adverse effect on agricultural resources:

- Effect AG-2: Conversion of Prime Farmland and Other Agricultural Land to Nonfarm Uses.

Implementing Alternatives 1 and 2 would convert an estimated 14,824 acres of Important Farmland to nonagricultural uses on the four project islands. Implementation of Alternatives 1 and 2 would also result in the loss of agricultural productivity on Bouldin Island.

The effect of converting Important Farmland and the resulting losses in agricultural production would be attenuated by some of the project features and actions, including enhancing the sustainability of agriculture within the place of use of water supplied by the project, restoring agricultural production on project islands used for water storage purposes, and contributing to the sustainability of in-Delta agriculture. In addition, implementing the following mitigation measure would help to reduce adverse effects associated with the conversion of agricultural land to nonagricultural uses. Restoring project lands to agricultural uses at the conclusion of the project would ensure that permanent conversion of agricultural land and production could be avoided; however, it would not reduce the long-term conversion of Important Farmlands during the 50-year life of the project. No other feasible mitigation is available to fully reduce this effect to a less-than-significant level.

Mitigation Measure: Implement Mitigation Measure AG-MM-1 (Provide Funding to Semitropic to Further District Goals of Sustaining Agriculture).

CTs 39 and 40.01 and the Thornton CDP have disproportionate minority populations relative to San Joaquin County demographics and the state as a whole, and CT 39 has low-income populations. The Hispanic population represented 72.6% and 53.0%, respectively, of the population within CTs 39 and 40.01 and 68.1% the population within the Thornton CDP. **No disproportionately high and adverse effects** on minority groups or low-income populations in CTs 39 and 40.01 and the Thornton CDP would occur. (Indirect effects on the agricultural economy that could affect minority and low-income populations are related to changes in agricultural-related employment and loss of personal income and are discussed in the "Socioeconomics" subsection below.)

Mitigation Measure: No mitigation is required.

Air Quality

As discussed in Section 3.3, "Air Quality," temporary and short-term construction-related activities associated with Alternatives 1 and 2 could result in carbon monoxide (CO), reactive organic gasses (ROG), and nitrogen oxides (NO_X) emissions that exceed applicable mass emission thresholds as identified in the following adverse, significant effects to air quality:

- Effect AIR-3: Increase in ROG Emissions on the Project Islands during Construction.
- Effect AIR-5: Increase in NO_X Emissions on the Project Islands during Construction.

Section 3.3 identifies the following mitigation measures, which would reduce these effects, but not to a less-than-significant level:

- Mitigation Measure AIR-MM-1: Perform Routine Maintenance of Construction Equipment.
- Mitigation Measure AIR-MM-2: Choose Borrow Sites Close to Fill Locations.
- Mitigation Measure AIR-MM-3: Prohibit Unnecessary Idling of Construction Equipment Engines.

CTs 39 and 40.01 are sparsely populated and generally consist of farmsteads and rural residences. In total, there are approximately 20 occupants on Bacon Island and approximately 40 occupants on Bouldin Island. These individuals may be minority, ethnic, and low-income; however, a disproportionate amount of minority or low-income individuals would not, by itself, constitute a minority or low-income population.

The nearest community to Bouldin Island is the Terminous CDP, which is located adjacent to the eastern border of the island and south of State Route (SR) 12. No minorities or low-income populations are present in the

Terminous CDP. The Thornton CDP includes a disproportionate minority population relative to San Joaquin County demographics and the state as a whole; however, the Thornton CDP is approximately 10 miles northeast of Bouldin Island. Air quality effects that may occur at such distances from the project islands would affect the study area's population essentially equally without regard to race, ethnicity, or income level. Therefore, n**o disproportionately high and adverse effects** on minority populations in CTs 39 and 40.01 and the Thornton CDP or low-income populations in CT 39 related to air quality would occur.

Mitigation Measure: No mitigation is required.

Cultural Resources

Section 3.7, "Cultural Resources," identifies the following potentially significant, adverse effects on historic buildings and structures:

- Effect CUL-1: Destruction of Historic Buildings and Structures on Bacon Island and Bouldin Island.
- Effect CUL-2: *Destruction of Levees and Unevaluated Built Environment Resources.*

Implementing Alternatives 1 and 2 could result in the destruction of historic buildings and structures on Bacon Island and Bouldin Island and the destruction of levees and unevaluated built environment resources. The majority of the buildings contributing to the National Register of Historic Places (NRHP) eligibility of the Bacon Island Rural Historic District would be adversely affected by reconstruction of the levees and inundation because all buildings are planned for demolition. Also, Alternatives 1 and 2 may damage the Mokelumne River Swing Truss Bridge, which is eligible for NRHP listing. In addition, levees and unevaluated built environment resources within the APE would be adversely affected by the reconstruction of levees and inundation if the resources are determined to be NRHP-eligible.

Section 3.7 identifies the following mitigation measures, which would reduce these effects, but not to a less-than-significant level:

- Mitigation Measure CUL-MM-1: Prepare and Implement a Historic Properties Treatment Plan.

- Mitigation Measure CUL-MM-1a: Complete Historic Research, Measured Drawings, and Photographic Documentation of the NRHP-Eligible Property.

- Mitigation Measure CUL-MM-1b: Prepare and Implement an Archaeological Resources Data Recovery Plan.

- Mitigation Measure CUL-MM-1c: Produce a Publication to Disseminate Historical Information Regarding the NRHP-Eligible Property to the Public.

- Mitigation Measure CUL-MM-1d: Prepare a Video That Disseminates Historical Information and Explains the Character-Defining Features of the NRHP-Eligible Property to the Public.

- Mitigation Measure CUL-MM-2: Inventory and Evaluate Built Environment Resources.

CTs 39 and 40.01 and the Thornton CDP have disproportionate minority populations relative to San Joaquin County demographics and the state as a whole, and CT 39 has low-income populations. All of the cultural resources in the Bacon Island Rural Historic District are considered "significant" (under NRHP guidelines) for their association with George Shima, a Japanese farmer influential in the development of Delta lands for agriculture following island reclamation. Mr. Shima employed Japanese tenant farmers during the early 1900s when laws prohibited Asians from owning land. Buildings and structures, although no longer contributing for their architectural integrity, still provide information regarding camp layout and function. Finally, seven known archaeological sites that contain material important to ongoing research on Japanese-American culture are present on the island. These resources represent a tangible link to the past. Because these resources may be especially significant to Japanese and Japanese-American populations and may also contain significance for the general public, including minority populations, disproportionately high and adverse effects on minority populations in CTs 39 and 40.01 and the Thornton CDP and other minority populations in the general public could occur. This environmental justice effect is **potentially significant**.

Mitigation Measure: Implement Mitigation Measure CUL-MM-1 (Prepare and Implement a Historic Properties Treatment Plan).

Mitigation Measure: Implement Mitigation Measure CUL-MM-1a (Complete Historic Research, Measured Drawings, and Photographic Documentation of the NRHP-Eligible Property).

Mitigation Measure: Implement Mitigation Measure CUL-MM-1b (Prepare and Implement an Archaeological Resources Data Recovery Plan).

Mitigation Measure: Implement Mitigation Measure CUL-MM-1c (Produce a Publication to Disseminate Historical Information Regarding the NRHP-Eligible Property to the Public).

Mitigation Measure: Implement Mitigation Measure CUL-MM-1d (Prepare a Video That Disseminates Historical Information and Explains the Character-Defining Features of the NRHP-Eligible Property to the Public).

Mitigation Measure: Implement Mitigation Measure CUL-MM-2 (Inventory and Evaluate Built Environment Resources).

Implementing Mitigation Measures CUL-MM-1a through CUL-MM-1d and CUL-MM-2 would reduce this potentially significant effect, but not to a less-than-significant level because project implementation would still result in the damage or destruction of NRHP-eligible properties. Therefore the environmental justice effects related to the loss of historic buildings and structures and the potential destruction of levees and unevaluated built resources are **significant and unavoidable**.

Aquatic Resources

Section 3.4, "Aquatic Resources," identifies the following significant, adverse effects on fisheries:

- Effect AQR-5: Project Effects on Juvenile Chinook Salmon.
- Effect AQR-6: Project Effects on Juvenile Steelhead.
- Effect AQR-7: Project Effects on Delta Smelt.
- Effect AQR-8: Project Effects on Longfin Smelt.
- Effect AQR-9: Project Effects on Green Sturgeon.

Implementation of Alternatives 1 and 2 would affect juvenile Chinook salmon, juvenile steelhead salmon, delta smelt, longfin smelt, and green sturgeon. Potential project effects on Chinook salmon and juvenile steelhead could result from changes in water quality due to project discharges; entrainment at project diversions and, to a lesser extent, during export of discharged project water; and increased Delta mortality because of altered hydrodynamics or false outmigration cues caused by project diversions. Delta smelt and longfin smelt may be affected by the project at several stages of the life cycle and project-related effects could result from entrainment loss of juveniles during export of discharged project water and diversions during January to June. Finally, effects on green sturgeon could occur from restricted distribution of juveniles as a result of discharges of project water.

Section 3.4 identifies the following mitigation measures, which would reduce these effects, but not to a less-than-significant level:

- Mitigation Measure AQR-MM-1: Conservation of Shallow-Water Vegetated Habitat.
- Mitigation Measure AQR-MM-2: Site Project Facilities to Avoid Existing Shallow-Water Vegetated Habitat.

- Mitigation Measure AQR-MM-3: Limit Waterside Construction to Less-Sensitive Time Periods.
- Mitigation Measure AQR-MM-4: Implement Best Management Practices for Waterside Construction.
- Mitigation Measure AQR-MM-5: Implement a Fishery Improvement Mitigation Fund.
- Mitigation Measure AQR-MM-6: Establish a Shallow-Water Aquatic Habitat Conservation Easement.

CTs 39 and 40.01 and the Thornton CDP have a disproportionate minority population relative to San Joaquin County demographics and the state as a whole, and CT 39 has low-income populations. Anglers of various races, ethnicities, and income levels fish on the project islands. There is no sport fishing for juvenile Chinook salmon, juvenile steelhead salmon, delta smelt, longfin smelt, and green sturgeon in the Delta. Therefore, **no disproportionately high and adverse effects** on minority populations in CTs 39 and 40.01 and the Thornton CDP or low-income populations in CT 39 related to aquatic resources would occur.

Mitigation Measure: No mitigation is required.

Land Use

Section 3.12, “Land Use,” identifies the following significant, adverse effect related to land use:

- Effect LU-4: Consistency with Zoning and General Plan Designations and Delta Protection Commission Land Use Plan Principles.

Removing land from agricultural production is inconsistent with the Delta Protection Commission’s (DPC’s) agricultural policy to support and encourage agriculture in the Delta as a key element in the state’s economy. It is also partially inconsistent with DPC’s agricultural policy to protect agricultural areas from inundation as the project would flood agricultural land in the Delta during periods of storage. In addition, because a substantial number of acres of prime farmland would be converted to nonagricultural use, it is inconsistent with the DPC’s agricultural policy that indicates that conversion of land to nonagricultural-oriented uses should occur where productivity and agricultural values are lowest. The project applicant has entered into an environmental commitment to place agricultural conservation easements on Bouldin Island and Holland Tract, which would help to reduce the level of this effect. However, no mitigation is available to fully reduce this effect to a less-than-significant level.

CTs 39 and 40.01 and the Thornton CDP have a disproportionate minority population relative to San Joaquin County demographics and the state as a whole, and CT 39 as low-income populations. However, inconsistencies between project implementation and Contra Costa County General Plan and DPC agricultural principles are related to land use regulations and not to a physical environmental consequence of project implementation. Therefore, **no disproportionately high and adverse effects** on minority populations in CTs 39 and 40.01 and the Thornton CDP or low-income populations in CT 39 would occur from such inconsistencies, in and of themselves. (Specific physical effects associated with the conversion of prime farmland to nonagricultural uses that could disproportionately affect minority and low-income populations are addressed above.)

Mitigation Measure: No mitigation is required.

Socioeconomics

Section 3.16, “Socioeconomics,” identifies the following significant adverse effects on socioeconomics:

- Effect SOCIO-4: Permanent Effects on Employment and Personal Income Resulting from Operation and Maintenance of Water Storage Facilities.

- Effect SOCIO-7: Permanent Effects on Agricultural Economics from Idling of Crops on the Project Islands.

Implementation of Alternatives 1 and 2 would remove existing agricultural operations on Bacon Island and Webb Tract, which would result in the direct and indirect loss of $2.7 million in personal income, $4.6 million in value added (i.e., wages and salaries, proprietor's and property incomes, dividends and interest, and indirect business taxes), and 99 jobs. Employment groups sustaining the greatest effects would include on-site farmworkers and losses of jobs and income for businesses that support the agricultural industry, including farm and equipment-supply stores and those that earn their income by selling, transporting, storing, marketing, and processing agricultural products, could occur. No feasible mitigation measures are available to reduce these effects to a less-than-significant level.

CTs 39 and 40.01 and the Thornton CDP have disproportionate minority populations relative to San Joaquin County demographics and the state as a whole, and CT 39 has low-income populations. The Hispanic population represented 72.6% and 53.0%, respectively, of the population within CTs 39 and 40.01 and 68.1% the population within the Thornton CDP. In CT 39, over 30% of the population income levels below the poverty threshold. Economic effects of crop idling tend to be concentrated within small subgroups, such as those within project islands. In this instance, if jobs for the small subgroups on the project islands were lost, those job losses could be a substantial adverse effect for those people (U.S. Bureau of Reclamation, California Department of Water Resources, U.S. Fish and Wildlife Service, NOAA Fisheries, and California Department of Fish and Game 2003). In addition, while a net increase in employment would result from operation and maintenance of water storage facilities, it cannot be assumed that these jobs would be filled by displaced agricultural workers because the skills required may not be comparable. Therefore, the loss of $2.7 million in personal income, $4.6 million in value added, and 99 jobs would disproportionately affect minority populations in CTs 39 and 40.01 and the Thornton CDP or low-income populations in CT 39. This environmental justice effect is **significant**.

Mitigation Measure: No feasible mitigation is available.

No feasible mitigation measures are available to reduce this significant effect to a less-than-significant level. Therefore, the environmental justice effects on minority and low-income populations related to loss of personal income and employment and crop idling are **significant and unavoidable**.

Alternative 3

EFFECT EJ-1 — Potential for Disproportionately High and Adverse Effects on Minority and Low-Income Populations in CT 3010 and the Bethel Island and the Terminous CDPs. *There are no minority populations recognized by the U.S. Census Bureau in CT 3010, the Bethel Island CDP, or the Terminous CDP that comprise greater than 50% of the population or are proportionally larger than in the county or the state. In addition, the percentage of the population below the poverty level in CT 3010, the Bethel Island CDP, and the Terminous CDP does not exceed 50% and is not meaningfully greater than of the percentage of the general population in the state living in poverty. Therefore, no disproportionately high and adverse effects on minority populations or low-income populations in CT 3010, the Bethel Island CDP, or the Terminous CDP would occur.*

Effects on minority and low-income populations associated with Alternative 3 are the same as described above for Alternatives 1 and 2. No minority populations recognized by the U.S. Census Bureau in CT 3010 and the Bethel Island CDP (in Contra Costa County), or the Terminous CDP (in San Joaquin County) are greater than 50% of the population or are proportionally larger than in the county or the state. People identifying themselves as Hispanic represented the largest non-white group in CT 3010, the Bethel Island CDP, and the Terminous CDP accounting for approximately 16.3%, 13.1%, and 10.5%, respectively, of the total population. However, these percentages are substantially lower than the average Contra Costa County population (24.2%), the average San Joaquin County population (38.9%), and the average state population (37.6%) identified as Hispanic. In addition, the percentage of the population below the poverty level in CT 3010 (18.9%), the Bethel Island CDP (16.5%), and the Terminous CDP (1.9%) does not exceed 50% and is not meaningfully greater than of the percentage of the general population in the state living in poverty (28.8%). Therefore, **no disproportionately high and adverse effects** on minority populations or low-income populations in CT 3010, the Bethel Island CDP, or the Terminous CDP would occur.

Mitigation Measure: No mitigation is required.

EFFECT EJ-2 **Potential for Disproportionately High and Adverse Effects on Minority and Low-Income Populations in the Places of Use.** *There are no minority populations recognized by the U.S. Census Bureau in the nine-county place-of-use area that comprise greater than 50% of the population or are proportionally larger than in the state. In addition, the population percentage in the nine-county area that is below the poverty level does not exceed 50% and is not meaningfully greater than of the percentage of the general population in the state living in poverty. Therefore, no disproportionately high and adverse effects on minority populations or low-income populations in the places of use would occur.*

Effects on minority and low-income populations associated with Alternative 3 would be the same as described above for Alternatives 1 and 2. There are no minority populations recognized by the U.S. Census Bureau in the nine-county place-of-use area that make up greater than 50% of the population or are proportionally larger than in the state. In addition, as shown in Table 3.8-4, the population percentage in the nine-county area below the poverty level does not exceed 50%. The population below the poverty threshold ranges from 9.9% in Ventura County to 21.4% in Kern County. Therefore, none of the counties within this study area have a proportion of low-income populations that would be considered meaningfully greater than that the state (28.8%). The project water would be used to improve water supply reliability for the current Semitropic, Metropolitan, Western, and Golden State water users, which include irrigation, domestic, and municipal and industrial beneficial uses. Therefore, **no disproportionately high and adverse effects** on minority populations or low-income populations in the places of use would occur.

Mitigation Measure: No mitigation is required.

EFFECT EJ-3 **Potential for Disproportionately High and Adverse Effects on Minority and Low-Income Populations in CTs 39 and 40.01 and the Thornton Island CDP.** *Minority populations in CTs 39 and 40.01 and the Thornton CDP are greater than 50%, and the percentage of low-income populations in CT 39 is meaningfully greater than the state as a whole; therefore, the project would result in disproportionately high and adverse effects on minority populations or low-income populations. This effect is significant.*

As described above for Alternatives 1 and 2, minority populations are present in CTs 39 and 40.01 and the Thornton Island CDP and low-income populations are present in CT 39. The Hispanic population within CTs 39 and 40.01 (72.6% and 53.0%, respectively) and the Thornton CDP (68.1%) are greater than 50% and are substantially greater than the average San Joaquin County (38.9%) and the average state population (37.6%) identified as Hispanic. In addition, the percentage of the population below the poverty level in CT 39 (30.3%) is meaningfully greater than of the percentage of the general population in the state living in poverty (28.8%). Therefore, project implementation could potentially cause disproportionately high and adverse effects on minority populations in CTs 39 and 40.01 and the Thornton CDP and low-income populations in CT 39.

Aesthetics, agricultural resources, air quality, aquatic resources, land use, socioeconomics, water supply, and traffic effects that would be significant and unavoidable and, thus, could cause disproportionately high and adverse effects on minority populations in CTs 39 and 40.01 and the Thornton CDP and low-income populations in CT 39 are the same as described above for Alternatives 1 and 2. In addition, implementation of Alternative 3 would result in significant and unavoidable effects related to water supply and conservation and water rights, and traffic and transportation that could cause disproportionately high and adverse effects on minority populations in CTs 39 and 40.01 and the Thornton CDP and low-income populations in CT 39. These effects are discussed below.

Aesthetics

Implementation of Alternative 3 would result in the following significant, adverse effects to visual resources:

- Effect VIS-3: Reduction in the Quality of Views of Bacon Island and Webb Tract from Adjacent Waterways and from the Santa Fe Railways Amtrak Line.

- Effect VIS-5: Reduction in the Quality of Views of the Habitat Islands from Adjacent Waterways.

Effects associated with Effect VIS-3 under Alternative 3 are the same as described above for Alternatives 1 and 2. As discussed in Effect VIS-5, Bouldin Island and Holland Tract would be used primarily for water storage under Alternative 3. Only a small portion of Bouldin Island would be used for habitat preservation. Constructing the water storage facilities would reduce the unity and intactness of the highly sensitive views from locally-designated scenic waterways by introducing built elements into a generally intact landscape. Implementation of Alternative 3 would also remove vegetation along project levees and introduce rock revetment, and siphon and pump station facilities along Bouldin Island and Holland Tract levees. These changes would substantially reduce the high quality of views from adjacent waterways and other existing recreation areas that are designated as scenic and sensitive.

Under Alternative 3, implementation of Mitigation Measures VIS-MM-1 and VIS-MM-2 (described above for Alternatives 1 and 2) would reduce the severity of these effects, but not to a less-than-significant level.
The reduced quality of views of the four project islands from adjacent waterways and of Bacon Island and Webb Tract from the Santa Fe Railways Amtrak line would affect all boaters and anglers that frequently use designated scenic waterways and passengers on the Amtrak line regardless of race, ethnicity, or income level. Therefore, **no disproportionately high and adverse effects** on minority populations in CTs 39 and 40.01 and the Thornton CDP or low-income populations in CT 39 related to aesthetics would occur.

Mitigation Measure: No mitigation is required.

Agricultural Resources

Implementation of Alternative 3 would result in the following significant, adverse effect on agricultural resources:

- Effect AG-2: Conversion of Prime Farmland and Other Agricultural Land to Nonfarm Uses.

Agricultural resource effects of Alternative 3 on Bacon Island and Webb Tract would be the same as those described previously for Alternatives 1 and 2. However, implementation of Alternative 3 would convert an additional approximately 10,006 acres of Important Farmland on Bouldin Island and Holland Tracts to water storage use. In total, Alternative 3 would convert 24,830 acres of land designated as Important Farmland.

For the same reasons discussed above under Alternatives 1 and 2, implementation of Mitigation Measure AG-MM-1 would not reduce the effect of conversion of prime and other farmlands during the 50-year life of the project to a less-than-significant level under Alternative 3, and no other feasible mitigation measures are available.

CTs 39 and 40.01 and the Thornton CDP have a disproportionate minority population relative to San Joaquin County demographics and the state as a whole and CT 39 has low-income populations. The Hispanic population represented 72.6% and 53.0%, respectively, of the population within CTs 39 and 40.01 and 68.1% the population within the Thornton CDP. N**o disproportionately high and adverse effects** on minority groups or low-income populations in CTs 39 and 40.01 or the Thornton CDP would occur. (Indirect effects on the agricultural economy that could affect minority and low-income populations are related to socioeconomics and are discussed in the "Socioeconomics" subsection below.)

Mitigation Measure: No mitigation is required.

Air Quality

Construction-related activities associated with Alternative 3 would result in the following significant, adverse effects on air quality:

- Effect AIR-3: Increase in ROG Emissions on the Project Islands during Construction.

- Effect AIR-5: Increase in NO_X Emissions on the Project Islands during Construction.

Under Alternative 3, implementation of Mitigation Measures AIR-MM-1, AIR-MM-2, and AIR-MM-3 (described above for Alternatives 1 and 2) would reduce effects associated with temporary and short-term construction-related generation of ROG and NO_X emissions, but not to a less-than-significant level.

Construction-related activities could affect residents within CTs 39 and 40.01 or low-income populations in CT 39. CTs 39 and 40.01 are sparsely populated and generally consist of farmsteads and rural residences. In total, there are approximately 20 occupants on Bacon Island and approximately 40 occupants on Bouldin Island. These individuals may be minority, ethnic, and low-income; however, a disproportionate amount of minority or low-income individuals would not, by itself, constitute a minority or low-income population.

The nearest community to Bouldin Island is the Terminous CDP, which is located adjacent to the eastern border of the island and south of SR 12. No minorities or low-income populations are present in the Terminous CDP. The Thornton CDP includes a disproportionate minority population relative to San Joaquin County demographics and the state as a whole; however, the Thornton CDP is approximately 10 miles northeast of Bouldin Island. Air quality effects that may occur at such a distance from the project islands would affect the study area's population essentially equally without regard to race, ethnicity, or income level. Therefore, n**o disproportionately high and adverse effects** on minority populations in CTs 39 and 40.01 and the Thornton CDP or low-income populations in CT 39 related to air quality would occur.

Mitigation Measure: No mitigation is required.

Aquatic Resources

Implementation of Alternative 3 would result in the following significant, adverse effects on fisheries:

- Effect AQR-5: Project Effects on Juvenile Chinook Salmon.
- Effect AQR-6: Project Effects on Juvenile Steelhead.
- Effect AQR-7: Project Effects on Delta Smelt.
- Effect AQR-8: Project Effects on Longfin Smelt.
- Effect AQR-9: Project Effects on Green Sturgeon.

Implementation of Alternative 3 would affect juvenile Chinook salmon, juvenile steelhead salmon, delta smelt, longfin smelt, and green sturgeon. Compared to Alternatives 1 and 2, Alternative 3 would double diversions to the Reservoir Islands and double discharge of water for export and outflow; there would be no diversions for habitat. This would lead to substantially greater effects than Alternatives 1 and 2. In general, doubling the diversions and exports would result in approximate doubling of the effects.

Under Alternative 3, implementation of Mitigation Measures AQR-MM-1, AQR-MM-2, AQR-MM-3, AQR-MM-4, AQR-MM-5, and AQR-MM-6 (described above for Alternatives 1 and 2) would reduce the severity or intensity of these effects, but not to a less-than-significant level.

CTs 39 and 40.01 and the Thornton CDP have a disproportionate minority population relative to San Joaquin County demographics and the state as a whole, and CT 39 has low-income populations. Anglers of various races, ethnicities, and income levels fish on the project islands. There is no sport fishing for juvenile Chinook salmon, juvenile steelhead salmon, delta smelt, longfin smelt, and green sturgeon in the Delta. Therefore, **no disproportionately high and adverse effects** on minority populations in CTs 39 and 40.01 and the Thornton CDP or low-income populations in CT 39 related to aquatic resources would occur.

Mitigation Measure: No mitigation is required.

Cultural Resources

Implementation of Alternative 3 would result in the following potentially significant, adverse effects on historic buildings and structures and human remains:

- Effect CUL-1: Destruction of Historic Buildings and Structures on Bacon Island and Bouldin Island.
- Effect CUL-2: Destruction of Levees and Unevaluated Built Environment Resources.
- Effect CUL-4: Disturbance to Human Remains as a Result of Compaction, Inundation, Wave-Induced Erosion, Habitat Development and Management, or Vandalism.

As discussed above under Alternatives 1 and 2, implementing Alternative 3 could result in the destruction of historic buildings and structures on Bacon Island and Bouldin Island and the destruction of levees and unevaluated built environment resources. In addition, ground-disturbing activities under Alternative 3 could disturb previously undiscovered burial sites containing human remains. Under Alternative 3, Mitigation Measures CUL-MM-1, CUL-MM-1a, CUL-MM-1b, CUL-MM-1c, CUL-MM-1d, and CUL-MM-2 (discussed previously) would be implemented and the following additional mitigation measures would be implemented for Effect CUL-4. These mitigation measures would reduce the severity of these effects, but not to a less-than-significant level:

> Mitigation Measure CUL-MM-1e: Provide Methods and Guidance for Subsurface Testing in the Form of Remote Sensing and Excavation.
>
> Mitigation Measure CUL-MM-1g: Negotiate, Prepare, and Implement a Preburial Agreement with the Most Likely Descendant (as Determined by the Native American Heritage Commission) of Potential Native American Interments Located in Webb Tract.
>
> Mitigation Measure CUL-MM-1h: Prepare and Implement an Archaeological Resources Data Recovery Plan for Site-Specific Resources.

CTs 39 and 40.01 and the Thornton CDP have disproportionate minority populations relative to San Joaquin County demographics and the state as a whole, and CT 39 has low-income populations. CTs 39 and 40.01 and the Thornton CDP have disproportionate minority populations relative to San Joaquin County demographics and the state as a whole, and CT 39 has low-income populations. As discussed above, all of the cultural resources in the Bacon Island Rural Historic District are "significant" (under NRHP guidelines) for their association with George Shima and seven known archaeological sites that contain material important to ongoing research on Japanese-American culture are present on the island. These resources represent a tangible link to the past. These resources may be especially significant to Japanese and Japanese-American populations and may also contain significance for the general public, including minority populations

Under of Alternative 3, earth-moving activities could disturb human remains on Webb Tract and Holland Tract as well as uncover previously undiscovered human burials on all four project islands. Sites that have human remains are especially significant to Native American populations since they provide a tangible link to the past and a resting place for interred ancestors. In addition, human burials may also contain significance for the general public, including minority populations. The affected Native American population cannot always be identified with specificity because members of tribes that attach significance to the resources in the Delta may reside in relatively remote locations rather than in adjacent census blocks or even counties.

Because adverse effects on historic buildings and structures on Bacon Island and human remains on all four project islands may be especially significant to minority populations, disproportionately high and adverse effects on minority populations in CTs 39 and 40.01 and the Thornton CDP and other minority populations in the general public could occur. This environmental justice effect is **potentially significant.**

Mitigation Measure: Implement Mitigation Measure CUL-MM-1 (Prepare and Implement a Historic Properties Treatment Plan).

Mitigation Measure: Implement Mitigation Measure CUL-MM-1a (Complete Historic Research, Measured Drawings, and Photographic Documentation of the NRHP-Eligible Property).

Mitigation Measure: Implement Mitigation Measure CUL-MM-1b (Prepare and Implement an Archaeological Resources Data Recovery Plan).

Mitigation Measure: Implement Mitigation Measure CUL-MM-1c (Produce a Publication to Disseminate Historical Information Regarding the NRHP-Eligible Property to the Public).

Mitigation Measure: Implement Mitigation Measure CUL-MM-1d (Prepare a Video That Disseminates Historical Information and Explains the Character-Defining Features of the NRHP-Eligible Property to the Public).

Mitigation Measure: Implement Mitigation Measure CUL-MM-1e: (Provide Methods and Guidance for Subsurface Testing in the Form of Remote Sensing and Excavation).

Mitigation Measure: Implement Mitigation Measure CUL-MM-1g (Negotiate, Prepare, and Implement a Preburial Agreement with the Most Likely Descendant [as Determined by the Native American Heritage Commission] of Potential Native American Interments Located in Webb Tract).

Mitigation Measure: Implement Mitigation Measure CUL-MM-1h (Prepare and Implement an Archaeological Resources Data Recovery Plan for Site-Specific Resources).

Mitigation Measure: Implement Mitigation Measure CUL-MM-2 (Inventory and Evaluate Built Environment Resources).

Implementing Mitigation Measures CUL-MM-1a through CUL-MM-1e, CUL-MM-1g, CUL-MM-1h**,** and CUL-MM-2 would reduce these potentially significant effects, but not to a less-than-significant level because project implementation would still result in the damage or destruction of NRHP-eligible properties and potentially result in the disturbance of previously undiscovered burials. Therefore the environmental justice effects related to the destruction of historic buildings and structures, destruction of levees and unevaluated built resources, and the loss of human remains are **significant and unavoidable**.

Land Use

Similar to Alternatives 1 and 2, implementation of Alternative 3 would result in the following significant, adverse effects related to land use:

- Effect LU-4: Consistency with Zoning and General Plan Designations and Delta Protection Commission Land Use Plan Principles.

Effects associated with Effect LU-4 would be the same as described above for Alternatives 1 and 2. No mitigation is available to reduce this effect to a less-than-significant level.

CTs 39 and 40.01 and the Thornton CDP include a disproportionate minority population relative to San Joaquin County demographics and the state as a whole, and CT 39 includes low-income populations. However, inconsistencies between project implementation and Contra Costa County General Plan and DPC agricultural principles are related to land use regulations and are not a physical environmental consequence of project implementation. Therefore, **no disproportionately high and adverse effects** on minority populations in CTs 39 and 40.01 and the Thornton CDP or low-income populations in CT 39 would occur from such inconsistencies, in and of themselves. (Specific physical effects associated with the conversion of prime farmland to nonagricultural uses that could disproportionately affect minority and low-income populations are addressed above.)

Mitigation Measure: No mitigation is required.

Socioeconomics

Implementation of Alternative 3 would result in the following significant, adverse effects on socioeconomics:

- Effect SOCIO-4: Permanent Effects on Employment and Personal Income Resulting from Operation and Maintenance of Water Storage Facilities.
- Effect SOCIO-7: Permanent Effects on Agricultural Economics from Idling of Crops on the Project Islands.

Effects associated with Alternative 3 would be greater than those described above for Alternatives 1 and 2. Implementation of Alternative 3 would remove existing agricultural operations on all four project islands, which would result in the direct and indirect loss of $18.8 million in production value, $5.2 million in personal income, $9.0 million in value added, and 192 jobs. Employment groups sustaining the greatest effects would include on-site farmworkers and workers in businesses that support the agricultural industry. No feasible mitigation measures are available to reduce these effects to a less-than-significant level.

CTs 39 and 40.01 and the Thornton CDP have disproportionate minority populations relative to San Joaquin County demographics and the state as a whole, and CT 39 has low-income populations. The Hispanic population represented 72.6% and 53.0%, respectively, of the population within CTs 39 and 40.01 and 68.1 % the population within the Thornton CDP. In CT 39, over 30% of the population income levels below the poverty threshold. Economic effects of crop idling tend to be concentrated within small subgroups, such as those within the project islands. In this instance, if the jobs associated with the subgroups on the project islands were lost, those job losses could be a substantial adverse effect for those people (U.S. Bureau of Reclamation, California Department of Water Resources, U.S. Fish and Wildlife Service, NOAA Fisheries, and California Department of Fish and Game 2003). In addition, while a net increase in employment would result from operation and maintenance of water storage facilities, it cannot be assumed that these jobs would be filled by displaced agricultural workers because the skills required may not comparable. Because minority and low-income populations are present within CTs 39 and 40.01 and the Thornton CDP, the loss of $5.2 million in personal income, $9.0 million in value added, and 192 jobs would disproportionately affect minority populations in CTs 39 and 40.01 and the Thornton CDP or low-income populations in CT 39. This environmental justice effect is **significant.**

Mitigation Measure: No feasible mitigation is available.

No feasible mitigation measures are available to reduce this significant effect to a less-than-significant level. Therefore, the environmental justice effects on minority and low-income populations related to loss of personal income and employment and crop idling are **significant and unavoidable**.

Water Supply

Section 3.19, “Water Supply,” identifies the following significant, adverse effect on water supply:

- Effect WS-1: Change in Delta Consumptive Use.

Conversion of the project islands from agriculture to water storage and wildlife habitat management would increase the Delta consumptive use of water from evaporation and/or crop transpiration. Total consumptive use under Alternative 3 is estimated to be substantially greater than under the No-Action Alternative. This increase in Delta consumptive use represents about a 1% increase in Delta lowland consumptive use. Daily accounting of project operations would be required under the protest dismissal agreements which define how the project would be operated independent of, and in a manner that does not adversely affect, the CVP and SWP Delta operations;

however, the increase in project-related consumptive use would be significant, and there are no feasible mitigation measures available to reduce the effect to a less-than-significant level.

The changes in Delta consumptive uses would occur from evaporation and/or crop transpiration. The project diversions, storage, discharge for exports, and releases for outflow would not interfere with any existing water users in the Delta and would not reduce the delivery to any CVP or SWP contractor. Therefore, **no disproportionately high and adverse effects** on minority populations in CTs 39 and 40.01 and the Thornton CDP or the low-income populations in CT 39 related to Delta consumptive water use would occur.

Mitigation Measure: No mitigation is required.

Traffic and Transportation

Section 3.17, Traffic and Transportation," identifies the following significant, adverse effect on traffic and transportation:

- Effect TRA-8: Fog Hazard for Roadway Traffic on SR 12.

As discussed in Section 3.17, implementation of Alternative 3 could increase the amount of fog produced along SR 12 on Bouldin Island by increasing the water surface area adjacent to the roadway thereby resulting in traffic hazards. There are no feasible mitigation measures available to reduce this effect to a less-than-significant level.

Traffic hazards that may occur from increased fog on SR 12 would affect all motorists on SR 12 regardless of race, ethnicity, or income level. Therefore, **no disproportionately high and adverse effects** on minority populations in CTs 39 and 40.01 and the Thornton CDP or low-income populations in CT 39 related to fog hazards would occur.

Mitigation Measure: No mitigation is required.

Table 3.8-5
Delta Wetlands Project Summary of Effects and Mitigation Measures for Environmental Justice

SEIS Effects and Mitigation Measures	Potential for Disproportionately High and Adverse Effects on Minority and Low-Income Populations
Alternatives 1 and 2 (Proposed Action)	
Effect EJ-1: Potential for Disproportionately High and Adverse Effects on Minority and Low-Income Populations in CT 3010 and the Bethel Island and the Terminous CDPs (NI) Mitigation: No mitigation is required.	No
Effect EJ-2: Potential for Disproportionately High and Adverse Effects on Minority and Low-Income Populations in the Places of Use (NI) Mitigation: No mitigation is required.	No
Effect EJ-3: Potential for Disproportionately High and Adverse Effects on Minority and Low-Income Populations in CTs 39 and 40.01 and the Thornton Island CDP (SU) • Cultural Resources **Mitigation Measures:** CUL-MM-1, CUL-MM-1a, CUL-MM-1b, CUL-MM-1c, CUL-MM-1d, CUL-MM-2 • Socioeconomics **Mitigation:** No feasible mitigation is available.	Yes

Table 3.8-5 **Delta Wetlands Project Summary of Effects and Mitigation Measures for Environmental Justice**	
SEIS Effects and Mitigation Measures	Potential for Disproportionately High and Adverse Effects on Minority and Low-Income Populations
Alternative 3	
Effect EJ-1: Potential for Disproportionately High and Adverse Effects on Minority and Low-Income Populations in CT 3010 and the Bethel Island and the Terminous CDPs (NI) Mitigation: No mitigation is required.	No
Effect EJ-2: Potential for Disproportionately High and Adverse Effects on Minority and Low-Income Populations in the Places of Use (NI) Mitigation: No mitigation is required.	No
Effect EJ-3: Potential for Disproportionately High and Adverse Effects on Minority and Low-Income Populations in CTs 39 and 40.01 and the Thornton Island CDP (SU) • Cultural Resources **Mitigation Measures:** CUL-MM-1, CUL-MM-1a, CUL-MM-1b, CUL-MM-1c, CUL-MM-1d, CUL-MM-1e, CUL-MM-1g, CUL-MM-1h, CUL-MM-2 • Socioeconomics **Mitigation:** No feasible mitigation is available.	Yes
Note: SU = Significant and unavoidable; NI = No impact Source: Data compiled by AECOM in 2013	

3.8.6 SECONDARY AND CUMULATIVE EFFECTS

Table 3.8-6 provides a summary of the secondary and cumulative effects related to Environmental Justice. Because the 2001 FEIS did not include this topic area, no comparison to that document is provided.

Potential for Disproportionately High and Adverse Effects on Minority and Low-Income Populations in CTs 39 and 40.01 and the Thornton Island CDP.

Minority populations are present in CTs 39 and 40.01 and the Thornton Island CDP and low-income populations are present in CT 39. Implementation of the Delta Wetlands project and other development projects in the Delta would result in cumulatively significant and unavoidable effects related to visual resources, agricultural resources, aquatic resources, air quality, and land use. These effects have the potential to result in disproportionately high and adverse effects on minority and low-income populations, and therefore are discussed below.

Reduction in the Quality of Views of the Reservoir Islands

As discussed in Section 3.1, "Aesthetics" project-related visual effects related to levee and infrastructure improvements would be significant and unavoidable for views in and outside the Reservoir Islands. Other development in the Delta could similarly degrade the overall visual quality of the Delta for viewer groups. Therefore, the project's contribution to this cumulatively significant effect is cumulatively considerable. Implementation of Mitigation Measures VIS-MM-1 and VIS-MM-2 would reduce the severity of the project's contribution, but not to a less-than-significant level. Therefore, the cumulative effect on visual resources resulting from implementation of the Delta Wetlands project and other development projects in the Delta is cumulatively significant and unavoidable.

The project-related reduced quality of views of the four project islands from adjacent waterways and of Bacon Island and from the Santa Fe Railways Amtrak line would not result in disproportionately high and adverse effects on minority populations in CTs 39 and 40.01 and the Thornton CDP or low-income populations in CT 39, because they would equally affect all viewer groups regardless of race, ethnicity, or income level. Similarly, changes in visual quality from implementing the other projects in the Delta considered in this cumulative analysis would also affect viewer groups regardless of race, ethnicity, or income level. Therefore, a cumulative environmental justice effect on minority and low-income populations related to aesthetics would not occur.

Conversion of Prime Farmland and Other Agricultural Land to Nonfarm Uses

Implementation of the project would contribute to the regional conversion of agricultural land. Alternatives 1 and 2 would convert an estimated 14,949 acres of important farmland (8,290 acres in San Joaquin County and 6,659 acres in Contra Costa County) and productive agricultural land to nonagricultural land uses. Alternative 3 would convert an additional approximately 10,006 acres of Important Farmland on Bouldin Island and Holland Tracts to water storage use. In total, Alternative 3 would convert 24,830 acres of land designated as Important Farmland. The related projects considered in this cumulative effects analysis include a number of projects that would convert agricultural lands to nonagricultural uses. Agricultural land conversions could occur through the urban development of Delta islands, levee improvement and flood control projects, or subsidence reduction programs.

As discussed in Section 3.2, “Agricultural Resources” the conversion of prime and other agricultural lands by the project and the related projects is a cumulatively significant and unavoidable effect. No feasible mitigation is available to reduce this effect to a less-than-significant level. It is extremely unlikely that a similar amount of land in the region with similar qualities and productivity could be brought into production to mitigate the effects resulting from the cumulative loss of agricultural land. Counties in the project region generally are losing farmland faster than new land is being brought into production. For example, between 2004 and 2006, approximately 6,618 acres of Important Farmland in San Joaquin County were converted to urban and other uses, while only 2,668 acres of grazing lands and other nonagricultural lands were converted to agricultural land.

Conversion of agricultural land to nonagricultural uses would not result in direct environmental justice effects on minority groups in CTs 39 and 40.01 and the Thornton CDP and low-income populations in CT 39. Similarly, conversion of agricultural land in other counties in the project region would not result in direct environmental justice effect. Rather, indirect effects on the agricultural economy, including estimated changes in employment, could affect minority and low-income populations in the study area and project region. These potential cumulative indirect effects are addressed below. Therefore, the direct cumulative effects associated with the conversion of agricultural land would not result in a cumulatively significant incremental contribution to significant and unavoidable cumulative environmental justice effects on minority and low-income populations.

Increase in Cumulative Production of Ozone Precursors and Carbon Monoxide in the Delta

As discussed in Section 3.3, “Air Quality,” project-related construction activities would generate emissions that exceed the regional thresholds for ROG, NO_X, and CO. Implementation of construction operational mitigation measures, the long-term operational emissions of the project would continue to exceed the regional CO thresholds of significance. Therefore, the project would result in a cumulatively considerable contribution to this cumulatively significant effect. Implementing Mitigation Measure AIR-MM-4 would reduce this effect, but not to a less-than-significant level. Thus, the cumulative effect of the project’s construction-related ROG, NO_X and CO would be significant and unavoidable. For operational emissions, the project’s CO emissions would be significant and unavoidable. Because the project’s emissions would be significant on a project-level and subsequently could affect attainment of ambient air quality standards, the project’s cumulative effects would be cumulatively considerable and unavoidable.

As discussed previously, the project’s construction-related generation of ROG, NO_X, and CO emissions would not disproportionately affect minority populations in CTs 39 and 40.01 and the Thornton CDP or low-income populations in CT 39. Other development in the Delta and the region could generate construction- and operation-related emissions that exceed the regional thresholds for ROG, NO_X, and CO. However, these effects would extend across the region and would not disproportionately fall on specific environmental justice populations.

Therefore, a cumulatively significant environmental justice effect on minority and low-income populations from emissions of ROG, NO_X, and CO would not occur.

Cumulative Effects on Listed Species

As discussed in Section 3.4, "Aquatic Resources," the project's effects in conjunction with ongoing cumulative conditions related to water diversions, contaminants, urbanization, climate change, and nonnative species are likely to reduce significantly the abundance of sensitive Delta fish species, namely salmonids, delta and longfin smelt, and green sturgeon. While the project's incremental contribution is very small, existing environmental conditions are substantially degraded and the additional increment could contribute further to the decline of these species. Therefore, the project's contribution to this cumulatively significant effect is cumulatively considerable. Implementing Mitigation Measures Mitigation Measures AQR-MM-1, AQR-MM-5, and AQR-MM-6 would reduce this effect, but not to a less-than-significant level. Thus, the cumulative effect of the project on listed species would be significant and unavoidable.

As discussed previously, the project's effects on listed species would not disproportionately affect minority populations in CTs 39 and 40.01 and the Thornton CDP or low-income populations in CT 39. Anglers of various races, ethnicities, and income levels fishing on the project islands; however, there is no sport fishing allowed for juvenile Chinook salmon, juvenile steelhead salmon, delta smelt, longfin smelt, and green sturgeon in the Delta. Therefore, a cumulatively significant environmental justice effect on minority and low-income populations would not occur.

Destruction of or Damage to NRHP-Eligible Properties and Historic Districts

During the last 25 years, many NRHP-eligible properties including the majority of agricultural labor camps in the Delta have been demolished or modified or have deteriorated without being documented or otherwise preserved. These resources represent the last vestiges of a once thriving agricultural period in the Delta. In addition, Bacon Island is one of the last intact agricultural labor camp systems in the Delta. The destruction of the NRHP-eligible resources including Bacon Island Rural Historic District would add to the loss of these historic resource types in the Delta. Implementation of Mitigation Measures CUL-MM-1a through CUL-MM-1d would reduce the project's contribution to this effect, but not to a level that is less-than-cumulatively considerable because project implementation would still result in the destruction of NRHP-eligible properties and historic districts. Therefore, this effect is cumulatively significant and unavoidable.

As discussed previously, the destruction of historic buildings and structure on Bacon Island and Bouldin Island, the destruction of levees and unevaluated built environment resources, would result in potentially disproportionate high and adverse effects on minority populations in CTs 39 and 40.01 and the Thornton CDP and other minority populations in the general public could occur. The destruction of the NRHP-eligible resources including Bacon Island Rural Historic District would add to the loss of these historic resource types in the Delta and would result in environmental justice effects. This cumulative environmental justice effect is potentially significant.

> Mitigation Measure: Implement Mitigation Measure CUL-MM-1 (Prepare and Implement a Historic Properties Treatment Plan).
>
> Mitigation Measure: Implement Mitigation Measure CUL-MM-1a (Complete Historic Research, Measured Drawings, and Photographic Documentation of the NRHP-Eligible Property).
>
> Mitigation Measure: Implement Mitigation Measure CUL-MM-1b (Prepare and Implement an Archaeological Resources Data Recovery Plan).
>
> Mitigation Measure: Implement Mitigation Measure CUL-MM-1c (Produce a Publication to Disseminate Historical Information Regarding the NRHP-Eligible Property to the Public).

Mitigation Measure: Implement Mitigation Measure CUL-MM-1d (Prepare a Video That Disseminates Historical Information and Explains the Character-Defining Features of the NRHP-Eligible Property to the Public).

Mitigation Measure: Implement Mitigation Measure CUL-MM-2 (Inventory and Evaluate Built Environment Resources).

Implementing Mitigation Measures CUL-MM-1a through CUL-MM-1d, and CUL-MM-2 would reduce this potentially significant cumulative effect, but not to level that is less-than-cumulatively considerable. Therefore, the cumulative effects associated with the destruction of historic structures and buildings on Bacon and Bouldin Islands, and destruction of levees and unevaluated built resources, would result in a cumulatively significant incremental contribution to significant and unavoidable cumulative environmental justice effects on minority and low-income populations.

Consistency with Zoning and General Plan Designations and Delta Protection Commission Land Use Plan Principles

The Delta Wetlands project would not be consistent with Contra Costa County General Plan or DPC's principles that promote the retention and production of agricultural land. The related projects considered in this cumulative analysis that would entail conversion of agricultural land to other uses in the Delta and in Contra Costa County, would also not be consistent with Contra Costa County General Plan or DPC's agricultural principles. Therefore, the Delta Wetlands Project, when considered in combination with the related projects where agricultural land conversion would occur in the Delta, would result in a cumulatively considerable contribution to this cumulatively significant effect. No feasible mitigation measures are available to reduce this effect to a less-than-significant level. Therefore, the cumulative effect of the project is significant and unavoidable.

As discussed previously, the inconsistencies between project implementation and Contra Costa County General Plan and DPC agricultural principles are issues related to land use regulations and do not result in a physical environmental effect from project implementation. Therefore, these inconsistencies would not result in disproportionately high and adverse effects on minority populations in CTs 39 and 40.01 and the Thornton CDP or low-income populations in CT 39, in and of themselves. Therefore, implementation of the project and the related projects in the Delta would not result in direct cumulative environmental justice effects on minority and low-income populations related to consistency with the Contra Costa County General Plan and DPC agricultural principles. (Physical effects associated with the conversion of prime farmland to nonagricultural uses that could disproportionately affect minority and low-income populations are addressed above.)

Permanent Effects on Employment and Personal Income Resulting from Operation and Maintenance of Water Storage Facilities

Conversion of the project islands to water storage facilities would directly and indirectly result in the loss of agricultural-related jobs and personal income. The related projects considered in this cumulative effects analysis include a number of projects that would convert agricultural lands to nonagricultural uses. Agricultural land conversions could occur through the urban development of Delta islands, levee improvement and flood control projects, or subsidence reduction programs and these conversions would further contribute to the loss of agricultural-related jobs and personal income in the Delta. The actual amount of agricultural land that may be converted by other projects is not known; therefore, there is no estimate of overall regional losses of jobs and personal income that would result from implementation of the related projects. However, counties in the project region generally are losing farmland faster than new land is being brought into production and that trend is anticipated to continue (see Section 3.2, "Agricultural Resources," for further discussion).

Employment groups sustaining the greatest effects would include on-site farmworkers and losses of jobs and income for businesses that support the agricultural industry, including farm and equipment-supply stores and those that earn their income by selling, transporting, storing, marketing, and processing agricultural products, would occur. The economic effects of crop idling on farmworkers tend to be concentrated within small subgroups of the regional economy, such as those within project islands and other islands in the Delta region. In this instance, if the jobs associated with the small subgroups on the project islands were lost, those job losses could be a substantial adverse effect for those people (U.S. Bureau of Reclamation, California Department of Water Resources, U.S. Fish and Wildlife Service, NOAA Fisheries, and California Department of Fish and Game 2003). No feasible mitigation measures are available to reduce this effect to a less-than-significant level and this effect would be significant and unavoidable. Therefore, when considered in combination with the continued loss of agricultural-related jobs and personal income in the Delta, the project's contribution to these effects would be cumulatively considerable.

The conversion of the project islands to water storage facilities would indirectly result in disproportionately high and adverse effects on minority groups in CTs 39 and 40.01 and the Thornton CDP and low-income populations in CT 39 from loss of agricultural-related jobs and personal income. Similarly, the loss of jobs and personal income in other counties in the project region would indirectly result in environmental justice effects. Therefore, this cumulative environmental justice effect is significant.

Mitigation Measure: No feasible mitigation is available.

No feasible mitigation measures are available to reduce this effect to level that is less-than-cumulatively considerable. Therefore, the cumulative effects associated with the loss of jobs and personal income would result in a cumulatively significant incremental contribution to significant and unavoidable cumulative environmental justice effects on minority and low-income populations.

Permanent Effects on Agricultural Economics from Idling of Crops on the Project Islands

As discussed in Section 3.16, Socioeconomics," implementation of the project would convert agricultural land uses to water storage facilities resulting directly in the loss of crop acreage and crop production value. The related projects considered in this cumulative effects analysis include a number of projects that would convert agricultural lands to nonagricultural uses. Agricultural land conversions could occur through the urban development of Delta islands, levee improvement and flood control projects, or subsidence reduction programs. These conversions would further contribute to the loss of crop acreage and crop production value in the Delta.

The actual amount of agricultural land that may be converted by other projects is not known; however, counties in the project region generally are losing farmland faster than new land is being brought into production. It is unlikely that a similar amount of land in the region with similar qualities and productivity could be brought into production to mitigate the effects resulting from the cumulative loss of crop acreage and crop production values. No feasible mitigation is available to reduce this cumulative effect to a less-than-significant level.

The effect of losses in agricultural production in Contra Costa and San Joaquin Counties would be attenuated by some of the project features and actions; however, these project features and actions would not reduce the long-term loss of crop acreage, crop production value, and value added during the 50-year life of the project. Therefore, the cumulative effect on agricultural economics resulting from implementation of the Delta Wetlands project and other related projects in the Delta is a cumulatively significant adverse effect.

The loss of crop acreage and crop production value would not directly result in environmental justice effects on minority groups in CTs 39 and 40.01 and the Thornton CDP and low-income populations in CT 39. Similarly, the loss of crop acreage and crop production value in other counties in the project region would not result in direct environmental justice effect. Rather, the loss of crop acreage and crop production value from this conversion would indirectly result in the loss of jobs and personal income. These potential cumulative indirect effects are addressed above. Therefore, the direct cumulative effects associated with the loss of crop acreage and production value would not result in a cumulatively significant incremental contribution to significant and unavoidable cumulative environmental justice effects on minority and low-income populations.

Table 3.8-6
Delta Wetlands Project Summary of Secondary and Cumulative Effects and Mitigation Measures for Environmental Justice

SEIS Cumulative Effects and Mitigation Measures	Potential for Cumulatively Disproportional High and Adverse Effects on Minority and Low-Income Populations
Potential for Disproportionately High and Adverse Effects on Minority and Low-Income Populations in CTs 39 and 40.01 and the Thornton Island CDP (CCU) • Cultural Resources **Mitigation Measures:** CUL-MM-1, CUL-MM-1a, CUL-MM-1b, CUL-MM-1c, CUL-MM-1d, CUL-MM-2 • Socioeconomics **Mitigation:** No feasible mitigation is available.	Yes

Note: CCU = Cumulatively considerable and unavoidable
Source: Data compiled by AECOM in 2013

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3.9 FLOODPLAIN MANAGEMENT

3.9.1 INTRODUCTION

This section describes recent changes to the existing environmental conditions and regulatory framework of the project study area, summarizes the unchanged affected environment, and describes changed environmental effects related to floodplain management for the project. A review and update of the 1995 DEIR/EIS floodplain management assessment was incorporated in the 2001 FEIS. Chapter 3D in the 2001 FEIS provided detailed information regarding floodplain management associated with the project and in the Sacramento-San Joaquin Delta (Delta) in general. The floodplain management effects of the project were analyzed most recently in Section 4.3 and Chapter 5 of the 2010 DEIR, which also served as a basis for this analysis. The 1995 DEIR/EIS, 2001 FEIS, and 2010 DEIR are herein incorporated by reference.

The 2001 FEIS concluded that the project alternatives would affect floodplain management for the four project islands. Since that time, there have been minor changes in the "Affected Environment" and "Regulatory Framework/Applicable Laws, Regulations, Plans, and Policies" subsections. However, there have been no changes in the project that result in new significant environmental effects or a substantial increase in the severity or intensity of previously identified significant effects related to floodplain management.

The floodplain management analysis has been updated here to reflect current environmental conditions on and around the project islands. This update includes levee design information based on recommendations for seepage reduction and projected sea-level rise (Hultgren-Tillis Engineers 2003). These changes are minor and do not affect the results of the analysis reported in the 2001 FEIS.

Identification of the project's specific places of use does not affect floodplain management in any way that alters the conclusions of the 2001 FEIS. The project would not have any direct adverse effects on floodplain management in the places of use; the effects on floodplain management, if any, associated with the provision of project water to the places of use are addressed in the "Secondary and Cumulative Effects" subsection below and in Chapter 4, "Other Statutory Requirements."

SUMMARY OF CHANGES, NEW CIRCUMSTANCES, AND NEW INFORMATION

Substantial Changes in the Project

Since the 2001 FEIS was completed, the project's levee design has been improved. Principally, the levee cross section has been increased, and new levee standards have been adopted to ensure consistency with the CALFED Bay-Delta program. Additionally, the project's Seepage Monitoring Program has been updated to incorporate the changes recommended under Mitigation Measure RD-2 in the 2001 FEIS. The project no longer includes a proposal to construct new recreation facilities on the Reservoir or Habitat Islands. These changes are described below and in Chapter 2, "Project Description and Alternatives," and do not result in any changes in the severity or intensity of previously identified effects related to floodplain management.

Proposed Levee Design

The 2001 FEIS included two distinct levee designs: one for the Reservoir Islands, and one for the Habitat Islands. The Reservoir Islands were to be designed to Public Law (PL) PL84-99 geometry standards, while the Habitat Islands were to be designed to the California Department of Water Resources (DWR) Bulletin 192-82 standards. However, since the 2001 FEIS was prepared, CALFED and DWR have adopted PL84-99 as the preferred design standard for Delta levees. Therefore, all four project islands under all three action alternatives would be designed to meet or exceed PL84-99 levee geometry standards at the time of construction (see Exhibit 2-9 in Chapter 2, "Project Description and Alternatives"). Proposed levee elevations for the Habitat and Reservoir Islands are based on the current hydraulic model used by local reclamation district engineers. Sea level rise is incorporated into on-going maintenance to provide adequate flood control. Maintenance activities would add material as necessary in response to actual sea-level rise rates over time. Future sea level rise predictions are not included in water surface calculations used in development of the proposed levee design.

Reservoir Islands

Under the Proposed Action in the 2001 FEIS, a typical improved levee would have an exterior slope of 2:1, a crest about 26 feet wide (including the thickness of erosion protection) at an elevation providing 1.5 feet of freeboard above the 100-year flood elevation, and a 3:1 initial interior slope transitioning to 10:1 approximately 10 to 15 feet below the crest elevation, creating a wide landside toe. This design is similar to what is now proposed; however, the new proposed design for Reservoir Island levees includes a greater crest width of 45 feet. This creates a larger and more stable levee than that proposed in the 2001 FEIS. The levee crest would be surfaced with an all-weather access road. The design also includes placement of fill and revetment on a 3:1 upper landside slope and a 10:1 lower toe berm slope that extends towards the interior until it intersects the island surface to create a landside buttress. The 45-foot-constructed crest width provides room for additional fill in anticipation of postconstruction settling. The wider initial levee top width would allow future maintenance activities to place material to increase heights to accommodate anticipated settling and sea-level rise, while still providing minimum top widths and acceptable side slopes after the material placement. This design also includes the addition of a core trench to reduce through-levee seepage potential, thereby increasing stability and safety. This proposed design is also similar to the geometric recommendations put forth in a report that investigated the levee stability of a “seismically repairable” levee, using Webb Tract for the analysis (Hultgren-Tillis Engineers 2009a). The seismically repairable geometry included similar crest width and side slopes and was found to perform well during large seismic events, allowing for quick repairs and increased stability. The new slopes in the current levee design would meet or exceed PL84-99 standards. Final levee design would be subject to engineering review.

Levee-improvement materials would be obtained primarily from sand deposits on the project islands. Each borrow area generally would be located more than 400 feet inward from the toe of a levee so that the borrow excavation would not cause structural effects to the levee and would be at least 2,000 feet inward from the final toe of an improved levee where a greater setback is necessary to control seepage.

The interior slopes of these perimeter levees would be protected from erosion by conventional rock revetment similar to that used on existing exterior slopes. In areas where final design studies indicate that wave splash and run-up potentially could erode the levee crest if it is unprotected, the levee crest would be hardened or the erosion-protection facing would be extended up as a splash berm.

Habitat Islands

Since the adoption of PL84-99 as the preferred standard for Delta levees, the Habitat Island levee design based on the Bulletin 192-82 standard was reevaluated. The change resulting from the adoption of the PL84-99 standard was a slight decrease in overall height from the 2001 FEIS design. In accordance with PL84-99 levee geometry standards, the new height provides 1.5 feet of freeboard above the 100-year water surface elevation rather than the 300-year water surface elevation. This change allows for approximately a 0.5-foot reduction in overall levee height from the proposed levee height in the 2001 FEIS.

Depth of Impounded Water

The 2001 FEIS analyzed the proposed impoundment of water to depths up to 6 feet (National Geodetic Vertical Datum of 1929 [NGVD 29]), which is a static datum and stable point of reference for this project. The proposed operations of all three action alternatives now limit the maximum impoundment depth to depths not exceeding 4 feet (NGVD 29) on any of the project islands.

NGVD 29 is the datum specified in the California Division of Safety of Dams (DSOD) regulations and is commonly used throughout the Delta. Each Reservoir Island currently has accurate benchmarks with elevation reported on the NGVD 29 datum. If needed in the future, this datum can be converted to another datum, but that would not change the allowable elevation of water in the reservoirs.

New Circumstances

Since the 2001 FEIS was completed, there have been many additional studies in the Delta and events that call into question the long-term sustainability of flood control and levee stability in the Delta. Specifically, the Delta Risk Management Strategy (DRMS) (California Department of Water Resources 2008) evaluated the potential for catastrophic levee failure, including failure of the levee on Jones Tract, and determined that “business as usual” practices are not sustainable in the Delta. Phase 1 of the DRMS project was completed in early 2009 (California Department of Water Resources 2008). Phase 2 of the DRMS project was completed in mid-2011 (California Department of Water Resources 2011). Separately, DWR considered potential for operational and maintenance changes to project islands and several miles of levees throughout the Delta. The results were summarized in the 2006 DRMS Supplemental Report which concluded that seepage models applied to estimate seepage rates at Webb Tract and Bacon Island were reasonable (California Department of Water Resources 2006). It went further to identify riprap as the recommended slope protection against wind and wave action. The risk analysis concluded that annual failure probability and the expected dollar risk during the 50-year project life are about 6 to 10 times greater under the existing conditions than for the proposed project. Overall the Proposed Action was considered to be technically feasible to safely design, construct, and operate.

Additionally, since the 2001 FEIS was completed, CALFED and DWR adopted PL84-99 as the target levee standard for all Delta levees to achieve. This new circumstance slightly alters the guidance for levee construction design standards on the Habitat Islands.

While there are new circumstances affecting floodplain management, these changes do not require major revisions to the previous analysis because there are no new significant adverse effects or increase in the severity or intensity of effects.

New Information

There is no new information of substantial importance that would result in an increase in severity or intensity of effects related to floodplain management. The key sources of new information reviewed or used to prepare this section consist of:

- Integrated Storage Investigations, *In-Delta Storage Program Draft Report on Engineering Investigations*, May 2002 (California Department of Water Resources and U.S. Bureau of Reclamation 2002a);
- Integrated Storage Investigations, *In-Delta Storage Program Draft Summary Report*, May 2002 (California Department of Water Resources and U.S. Bureau of Reclamation 2002b);
- *In-Delta Storage Program Final Draft Report on Risk Analysis*, December 2001 (U.S. Bureau of Reclamation and California Department of Water Resources 2001);
- *In-Delta Storage Program Draft Report on Embankment Design Analysis*, URS June 2003 (California Department of Water Resources 2003a);
- *In-Delta Storage Program Draft Report on Flooding Analysis*, URS June 2003 (California Department of Water Resources 2003b);
- *In-Delta Storage Program Draft Report on Risk Analysis*, URS June 2003 (California Department of Water Resources 2003c);

- *Preliminary Design Report, Reservoir Island Levees, Delta Wetlands project, Sacramento–San Joaquin River Delta,* Hultgren-Tillis Engineers, March 11, 2003;

- *Geotechnical Evaluation, Sea Level Rise, Webb Tract Levees, Sacramento-San Joaquin Delta,* Hultgren-Tillis Engineers, December 10, 2009 (Hultgren-Tillis Engineers 2009a);

- *Geotechnical Evaluation, Seismically Repairable Levee, Webb Tract, Sacramento–San Joaquin Delta,* Hultgren-Tillis Engineers, December 30, 2009 (Hultgren-Tillis Engineers 2009b);

- *In-Delta Storage Program Draft Report on Risk Analysis,* URS May 31, 2005 (California Department of Water Resources 2005); and,

- *2006 Supplemental Report to the 2004 Draft State Feasibility Study In-Delta Storage Project*, URS May 2006 (California Department of Water Resources 2006).

SUMMARY OF ENVIRONMENTAL COMMITMENTS

Environmental commitments are measures incorporated by the project applicant as part of the project description, meaning they are proposed as elements of the Proposed Action and are therefore considered in conducting the environmental analysis for each resource area of this SEIS. The purpose of environmental commitments is to reflect and incorporate best practices into the project that avoid, minimize, reduce, or offset potential adverse environmental effects. A description of the environmental commitments that have been incorporated into the project since the 2001 FEIS are contained in Chapter 2, “Project Description and Alternatives” of this SEIS. The environmental commitments relevant to floodplain management are discussed below.

Prior Agreement with East Bay Municipal Utility District

The Settlement Agreement between East Bay Municipal Utility District (EBMUD) and the project applicant, signed on September 13, 2000, stipulates that a Reservoir Island design review board will serve as an oversight committee for the Reservoir Islands while construction is ongoing. A Reservoir Island monitoring and action board will serve as a technical review committee for operations of the Reservoir Islands and for enforcing the implementation of the project seepage control plan.

Improved Reservoir Island Levee Design

Based on the recommendations by Hultgren-Tillis Engineers contained in the 2003 document, *Preliminary Design Report: Reservoir Island Levees, Delta Wetlands Project*, the proposed Reservoir Island levee design has been improved to provide increased stability and reduced through-levee seepage potential, as described above under “Proposed Levee Design.” This improved levee design is considered an environmental commitment.

Seepage Monitoring and Control Program

The Seepage Monitoring and Control Program, which was developed to avoid seepage issues and to provide early detection of seepage problems caused by the project, has been updated to incorporate the changes recommended under Mitigation Measure RD-2 in the 2001 FEIS. The project applicant has now committed to this program as an environmental commitment. The changes to the Seepage Monitoring and Control Program are as follows:

- Locate the background monitoring wells at least 1,000 feet from the nearest seepage monitoring wells.

- Use more than one background monitoring well for each row of seepage monitoring wells.

- Use at least 1 year of data to establish reference water levels in all the background monitoring wells and in at least half of the seepage monitoring wells.

- Reevaluate seepage performance standards 2, 5, and 10 years after reservoir operations begin and then every 10 years.

3.9.2 Affected Environment

Floodplain management conditions are, for the most part, the same as they were presented in the 2001 FEIS and are herein incorporated by reference and summarized below.

Delta Levee Conditions

The Delta levee system initially served to control island flooding. Today the levees are necessary to prevent inundation of island interiors during normal runoff and tidal cycles because island interiors have been lowered by extensive soil subsidence. Subsidence is the lowering of the interior land level primarily as a result of microbial decomposition, topsoil erosion, and oxidation of the islands' peat soils.

Many Delta levee failures have occurred since the levees were first constructed in the 1890s. Levee failures occur as a consequence of overtopping or levee instability. Overtopping occurs when the crest of the levee is lower than the water level. Overtopping can occur not only as a result of floodflows, but also as a consequence of high tides and wind. Factors contributing to levee instability consist of seepage, settlement, erosion, subsidence, and seismicity. Water seeping through or beneath levees contributes to erosion problems and subsequent levee instability. Sandy levees are especially susceptible to seepage erosion and the resulting formation of "pipes" (large voids) in the levee material. The construction of Delta levees over soft foundation materials has caused ongoing consolidation of levee material and levee settlement. Delta islands are subject to levee cracking, seepage, and instability of varying degrees because of differential settlement and the composition of the levee soils. The levees are raised periodically to compensate for settlement. The process of raising levees increases the load on the underlying materials, causing more settlement, and the cycle repeats itself. Levee exterior (waterside) slopes are subject to varying erosional effects from channel flows, tidal action (which can cause water levels in some channels to vary by as much as 4 feet daily), wind-generated waves, and boat wakes. To counter erosion, riprap (rock) may be placed on a levee, or a berm may be placed as a buffer in front of the levee. Subsidence (i.e., lowering of the land surface) results primarily from peat soil being converted into a gas. Many Delta islands are composed of peat soils that decompose when exposed to oxygen and higher temperatures, a process that is accelerated by agricultural activity. None of the Delta levee failures that have occurred are known to have been the direct result of an earthquake. However, an earthquake could potentially cause levee failures through lateral deformation, settlement, or liquefaction because Delta levees are founded on sand, silt, clay, and peat that, when saturated, generally lose strength under seismic acceleration. (ICF 2001:3D-2 through 3D-4.)

Project Island Levee Conditions

Since 1932, two project islands−−Holland and Webb Tracts−−have flooded as a result of levee overtopping or stability failure. As indicated in the 2001 FEIS (ICF 2001:3D-4), USACE has predicted that Bouldin Island would experience levee failure more than 18 times in 100 years, or an average of once every 5.5 years under existing conditions. The U.S. Army Corps of Engineers (USACE) predicted that levees on Bacon Island, Holland Tract, and Webb Tract would fail once every 11-24 years under existing conditions.

The project islands and adjacent islands experience seepage problems of varying degrees under existing conditions. Existing levees will continue to have at least some high seepage caused by the high hydraulic heads between exterior water surfaces and interior island bottoms. Site-specific data on seepage in the project area indicate that water levels in sand aquifers are within a few feet of the interior elevations of the islands (ICF 2001:3D-4).

Levees on Delta islands generally consist of a layer of fill, about 10 feet thick, composed mostly of sand with some peat and clay. The fill is underlain by peat and soft clay, which in turn is typically underlain by sand, silt, and clay. The peat and soft clay foundation materials are highly compressible and create continual settlement problems for the project island levees.

The project islands are subject to varying erosional effects from wind-generated waves, channel flows, and tidal action. Exterior levee slopes on the project islands are constructed with erosion control material (e.g., riprap) to counter wind and wave erosion.

If current agricultural practices continue, the surfaces of the project islands will decline roughly 6-10 feet over the next 50 years, assuming peat layers are at least 10 feet thick (ICF 2001:3D-5).

No active faults are known to pass beneath the project islands, although the islands are within the zones of influence of several active faults. The major active fault systems and their distances west of Webb Tract consist of the Concord-Green Valley (22 miles), Calaveras (27 miles), Hayward (37 miles), Rodgers Creek (43 miles), San Andreas (54 miles), and Vacaville/Winters (26 miles) fault systems (ICF 2001:3D-5).

Levee systems throughout the Delta are either Federal “project levees” or “nonproject levees”. “Project levees” within the Delta are maintained to USACE standards by the State of California or by local landowners under state supervision. “Nonproject levees” are defined as levees constructed and maintained by local landowners and reclamation districts. The four project islands are completely bounded by nonproject levees. On Webb Tract, the nonproject levee along the San Joaquin River on the north side of the island borders the Stockton ship channel and is classified as a “direct agreement” levee. The Port of Stockton has assured the Federal government that this and other direct agreement levees will be maintained. (ICF 2001:3D-5.)

Levees on Bacon Island are maintained by Reclamation District No. 2028, Webb Tract levees are maintained by Reclamation District No. 2026, Bouldin Island levees are maintained by Reclamation District No. 756, and Holland Tract levees are maintained by Reclamation District No. 2025. The district engineer for each reclamation district inspects the island levees in spring and fall or when levee problems are reported by the local landowners. The district engineer generally specifies, supervises, and coordinates any required levee repair or rehabilitation. Levee maintenance can be performed by the reclamation district at any time during the year and can include vegetation control, road maintenance, and the raising of levees that have subsided. (ICF 2001:3D-6 and 3D-7.)

3.9.3 Regulatory Framework/Applicable Laws, Regulations, Plans, and Policies

Federal applicable laws and regulations are provided because they are required under NEPA. State applicable laws and regulations are provided for informational purposes and to assist with NEPA review. USACE has considered applicable state, regional, and local plans and ordinances as a part of the environmental review process for this SEIS, where applicable.

Federal

U.S. Army Corps of Engineers Engineering Circular 1165-2-211

In July 2009, USACE issued Engineering Circular (EC) EC 1165-2-211, a water resource policy mandating that every USACE coastal activity influenced by tidal waters include potential relative sea-level change in the starting water surface elevation, where appropriate. To comply, projects must determine how sensitive plans and designs are to rates of future local mean sea-level change, how this sensitivity affects calculated risk, and what design or operations and maintenance measures should be implemented to minimize adverse consequences while maximizing beneficial effects.

The project is not a USACE activity subject to EC 1165-2-211; however, the project would include maintenance operations that would require placement of levee materials as necessary to maintain freeboard in response to actual sea-level rise rates.

U.S. Army Corps of Engineers Engineering Technical Letter 1110-2-571

Post Hurricane Katrina investigations brought scrutiny to levee management practices throughout the United States, particularly within communities that rely upon levees to protect against flood waters and tidal surges. In response, in April 2009, USACE issued Engineering Technical Letter (ETL) ETL 1110-2-571, a levee management policy concerning landscape planting and vegetation management. This policy does not permit landscape planting to be incorporated into the design of flood damage reduction projects, where the safety of the structure may be compromised, or effective surveillance, monitoring, inspection, maintenance, and flood-fighting of the facility are adversely affected. Project levees are not subject to USACE jurisdiction because they are not USACE levees or a flood damage reduction project; however, the surface treatments and landscaping plans generally would be consistent with the USACE's ETL guidance.

Levees meeting eligibility requirements for the PL84-99 program must comply with ETL 1110-2-571 or a vegetation variance adopted by the local USACE district and approved by headquarters. However, at this time, the project applicant does not intend to participate in the PL84-99 program and therefore is not required to meet the ETL vegetation standards.

STATE

California Division of Safety of Dams

The California Division of Safety of Dams (DSOD) has oversight and approval authority for structures that are considered dams under the California Water Code. Some levees are "dams" as defined by California Water Code Section 6002, and as such, are required to meet DSOD's standards and design review requirements. Dams that fall under DSOD jurisdiction are artificial barriers that are at least 25 feet high or have an impounding capacity of at least 50 acre feet.

However, Water Code Section 6004(c) specifically excludes structures in the Sacramento-San Joaquin Delta "…if the maximum possible water storage elevation of the impounded water does not exceed four feet above mean sea level, as established by the United States Geological Survey 1929 Datum." The 2001 FEIS indicated that project levees would be subject to DSOD jurisdiction and approval. However, the revised project design has now incorporated operational controls to limit the depth of storage in project island reservoirs to levels that are below DSOD jurisdictional thresholds. Therefore, DSOD oversight is no longer applicable to the proposed water storage facilities. However, Wilkerson Dam, which would be constructed on Bouldin Island under Alternative 3, would be subject to DSOD jurisdiction and approval.

3.9.4 ANALYSIS METHODOLOGY

Effects on floodplain management were evaluated through comparison of the levee improvement design for the Proposed Action and project alternatives with conditions studied, based primarily on results of geotechnical investigations conducted for the project. The geotechnical studies included field investigations, monitoring, modeling, and levee stability analyses for the project islands. As stated above, the design for project island levees has been modified since the 2001 FEIS based on the *Preliminary Design Report: Reservoir Island Levees, Delta Wetlands Project* prepared by Hultgren-Tillis Engineers in 2003. Previous geotechnical studies and independent evaluations related to levee design, stability, and seepage have been conducted for the 1995 EIR/EIS, 2000 REIR/EIS, and 2001 FEIS, all of which have contributed to the design and analysis of project island levees, and the prior environmental documents along with their appendices are incorporated herein by reference.

SIGNIFICANCE CRITERIA

The basis for determining the significance of effects for this analysis is based on professional standards, project-specific criteria developed by the lead agency to address potential effects unique to the project's location and elements, and is informed by the criteria contained in the Environmental Checklist in Appendix G of the State

CEQA Guidelines. These thresholds encompass the factors taken into account under NEPA to determine the significance of an action in terms of its context and the intensity of its effects. The Proposed Action or alternatives under consideration would have a significant, adverse effect related to floodplain management if they would do any of the following:

- substantially decrease levee stability on the project islands during project construction;
- substantially induce additional seepage on adjacent islands when compared to no-project conditions;
- substantially decrease regional supplies of levee material;
- substantially decrease long-term levee stability on the project islands below long-term stability under existing conditions; or
- substantially increase risk of cumulative levee failure and flooding in the project vicinity.

3.9.5 ENVIRONMENTAL CONSEQUENCES AND MITIGATION MEASURES

EFFECTS ANALYSIS

Effects on floodplain management resulting from project implementation were described in the 2001 FEIS (Chapter 3D) and are listed below in Table 3.9-1. Where there have been no changes to the effects analysis or conclusions, the 2001 FEIS is incorporated by reference, and the effects conclusions and mitigation measures are briefly summarized.

No-Action Alternative

EFFECT FM-1 Change in Long-Term Levee Stability on Reservoir Islands. *The proposed levee improvements would not occur under the No-Action Alternative, and therefore long-term levee stability would likely decrease. This effect is potentially significant.*

Under the No-Action Alternative, the project levees would continue to be maintained as agricultural levees. Levee geometries (width, side slope, and height) would remain at current levels, with fill placed to repair storm-related damage and material placed to maintain appropriate heights to offset levee settlement and sea-level rise. Hultgren-Tillis confirms that the existing safety and reliability of the project levees can be maintained with rising sea level by raising the levee crest and providing a broader toe berm (Hultgren-Tillis 2009a and 2009b). Maintenance practices would continue at their current levels as the local reclamation districts strive to achieve the adopted PL84-99 standard as the preferred Delta island levee geometry with limited resources. This effect is **potentially significant**.

EFFECT FM-2 Potential for Seepage from Reservoir Islands to Adjacent Islands. *The proposed levee improvements would not be implemented; therefore, the potential for seepage would likely increase. This effect is potentially significant.*

Under the No-Action Alternative, the proposed water storage facilities would not be constructed; thus, there would be no potential for seepage beneath the Reservoir Island levees to adjacent islands during project operation from an increase in the hydraulic head between Reservoir Islands and adjacent islands during periods of storage. In anticipation of a potential water storage project, agricultural activities on the project islands have been reduced over time. The No-Action Alternative would see a return to historical intense agricultural activity on each of the four project islands. High levels of agricultural land use would return the area to higher levels of subsidence through oxidation of peat soils. This subsidence would increase the hydrostatic pressure on the island levees, increasing the risk of wet weather and dry weather levee seepage problems typical of all Delta islands. This effect is **potentially significant.**

EFFECT FM-3	Potential for Wind and Wave Erosion on Reservoir Islands. *Because the project would not be implemented, there would be no increased susceptibility to wind and wave erosion from water storage facilities. No effect would occur.*

Because the proposed water storage facilities would not be constructed, Implementation of the No-Action Alternative would not result in wind and wave erosion of the interior levee slopes of perimeter levees on the Reservoir Islands from long wind fetch across the islands and the water depths during water storage. Therefore, **no effect** would occur.

EFFECT FM-4	Potential for Erosion of Levee Toe Berms at Pump Stations and Siphon Stations on Reservoir Islands. *The proposed facilities would not be implemented, therefore increased erosion of levees from the proposed facilities would not take place. No effect would occur.*

Because the proposed pump and siphon stations would not be constructed, an associated increased erosion potential along the levee toe berms of the Reservoir Islands would not take place, and **no effect** would occur.

EFFECT FM-5	Change in Potential for Levee Failure on Project Islands During Seismic Activity. *The proposed levee improvements would in not be implemented, and therefore levee stability during seismic activity would likely decrease. This effect is potentially significant.*

Implementing the No-Action Alternative would provide less flood control benefit and decreased levee stability through greater potential subsidence and greater potential hydrostatic pressure, which would increase the potential for seismically-induced levee failures. This effect is **potentially significant**.

EFFECT FM-6	Change in Long-Term Levee Stability on Habitat Islands. *The proposed levee improvements would not occur and agriculture would intensify, and therefore long-term subsidence of the Habitat Islands would continue. This effect is potentially significant.*

Under the No-Action Alternative, the project levees would continue to be maintained as agricultural levees. Levee geometries (width, side slope, and height) would remain at current levels, with fill placed to repair storm-related damage and material placed to maintain appropriate heights to offset levee settlement and sea-level rise. Because the proposed levee improvements would not occur and because agricultural activities would intensify, the rate of subsidence on Bouldin Island and Holland Tract from agricultural use would not be arrested. Continuing subsidence would contribute to decreased long-term levee stability on the Habitat Islands. This effect is **potentially significant**.

Alternative 1 and Alternative 2 (Proposed Action)

The effects analysis and mitigation measures for Alternatives 1 and 2 are the same; therefore, they are described together under this heading.

EFFECT FM-1	Change in Long-Term Levee Stability on Reservoir Islands. *The proposed levee improvements have been designed to improve long-term stability, including maintenance to address settlement and sea-level rise. This effect is less than significant.*

The proposed levee design includes improved side slopes, erosion countermeasures (revetment), seepage reduction measures, and overall mass to improve stability over existing conditions and provide adequate flood control characteristics. Both Reservoir and Habitat Island levees would be reconstructed (i.e., improved) to geometries that meet or exceed PL84-99 standards. Both the Reservoir and Habitat Island levees would be maintained to address settlement and sea-level rise. Because the project now incorporates a revised levee design to address long-term levee stability, this effect is **less than significant**.

Mitigation Measure: No mitigation is required.

EFFECT FM-2 **Potential for Seepage from Reservoir Islands to Adjacent Islands.** *The proposed levee improvements have been designed to address seepage, including implementation of a Seepage Monitoring and Control System. This effect is less than significant.*

Implementation of Alternatives 1 or 2 could increase the potential for seepage beneath the Reservoir Island levees to adjacent islands during project operation by increasing the hydraulic head between Reservoir Islands and adjacent islands during periods of storage. However, the project now includes implementation of a Seepage Monitoring and Control System as an environmental commitment to determine seepage flow rates, collect excess seepage, and maintain acceptable seepage rates and quantities over the life of the project. Reservoir Island levees would be designed to include a core trench and interceptor well system to provide a levee seepage barrier. Final levee designs are subject to engineering review before construction. Therefore, this effect is **less than significant**.

Mitigation Measure: No mitigation is required.

EFFECT FM-3 **Potential for Wind and Wave Erosion on Reservoir Islands.** *The proposed levee improvements incorporate features designed to withstand wind and wave erosion. This effect is less than significant.*

Implementation of Alternatives 1 and 2 could result in wind and wave erosion of the interior levee slopes of perimeter levees on Reservoir Islands because of the long wind fetch across the islands and the water depths during water storage. However, the proposed island levee improvements incorporate features designed to withstand wind and wave erosion. Appropriate levee heights have been determined to accommodate expected wave heights, and rock revetment has been designed to dissipate wave energy and counteract erosive forces. Therefore, this effect is **less than significant**.

Mitigation Measure: No mitigation is required.

EFFECT FM-4 **Potential for Erosion of Levee Toe Berms at Pump Stations and Siphon Stations on Reservoir Islands.** *The proposed levee improvements have been designed to reduce erosion. This effect is less than significant.*

Implementation of Alternatives 1 or 2 would not cause substantial levee toe erosion at siphon and pump stations on interior or exterior levee slopes. Pump and siphon units would be equipped with expansion chambers, which reduce flow through dissipation, and routine inspection and maintenance of the levees would identify any erosion problems and include implementation of erosion control measures as needed. The current Reservoir Island levee design would further reduce erosion potential through placement of revetment and erosion countermeasures that are typical for Delta islands and are easily maintainable over the life of the project. Therefore, this effect is **less than significant**.

Mitigation Measure: No mitigation is required.

EFFECT FM-5 **Change in Potential for Levee Failure on Project Islands During Seismic Activity.** *The proposed levee improvements would increase levee stability during seismic activity. This effect is less than significant.*

The proposed design for all four project island levees would meet or exceed PL84-99 levee geometry criteria, creating a wider and more stable levee mass that exceeds the existing levee geometry on any of the project islands. The project therefore would reduce the potential for levee failure on project islands during seismic activity as described in the Hultgren-Tillis (2009b) report. The proposed design would undergo necessary engineering review required by county planning agencies. The project also incorporates the environmental commitments described earlier this section, which include a Reservoir Island review, monitoring, and action board; implementation of an improved project levee design; and implementation of a Seepage Monitoring and Control Program, all of which would help to improve levee stability over existing conditions. Thus, project implementation would result in more stable levees on all four islands during seismic activity than would exist without the implementation of the project. Therefore, this effect is **less than significant**.

Mitigation Measure: No mitigation is required.

EFFECT FM-6 Increase in Long-Term Levee Stability on Habitat Islands. *The proposed levee improvements would increase long-term stability on the Habitat Islands. This effect is beneficial and less than significant.*

The proposed Habitat Island levee design includes side slopes, erosion countermeasures (revetment), seepage reduction measures, and overall mass to improve stability over existing conditions and provide adequate flood control characteristics. This design would create a larger levee than currently exists and would provide for long-term stability through its larger size, shallow slopes, and improved erosion countermeasures. Habitat Island levees would be constructed to meet PL84-99 geometry and maintained to address settlement and sea-level rise. Furthermore, as discussed in the 2001 FEIS, implementation of Alternatives 1 or 2 would slow the rate of subsidence on Bouldin Island and Holland Tract relative to subsidence rates under existing agricultural use. Decreased subsidence would contribute to increased long-term levee stability on the Habitat Islands. Therefore, this effect is **beneficial and less than significant**.

Mitigation Measure: No mitigation is required.

Alternative 3

EFFECT FM-1 Change in Long-Term Levee Stability on Reservoir Islands. *The proposed levee improvements have been designed to improve long-term stability, including maintenance to address settlement and sea-level rise. This effect is less than significant.*

The exterior levees of the four project islands would be reconstructed as described for levee reconstruction on Webb Tract and Bacon Island under Alternatives 1 and 2. The revised levee design, construction practices, and Seepage Monitoring and Control Program that have been incorporated into the project as environmental commitments for Reservoir Island perimeter levees for Alternative 3 would be the same as described above for Alternatives 1 and 2. Implementation of Alternative 3 would require interior levees to be constructed around several parcels that are not owned by Delta Wetlands Properties: the two marina sites at the south edge of Holland Tract, and across Bouldin Island on the southern and northern sides of State Route (SR) 12. The toe of the proposed interior levee along the southern side of SR 12 across Bouldin Island would be set back from the highway to protect the roadbed from any settlement caused by the new levee. Because all four project island levees would be improved to geometries that meet or exceed PL84-99 standards, these levees would be maintained to address settlement and sea-level rise, and this effect is **less than significant**.

Mitigation Measure: No mitigation is required.

EFFECT FM-2 Potential for Seepage from Reservoir Islands to Adjacent Islands. *The proposed levee improvements have been designed to address seepage, including implementation of a Seepage Monitoring and Control System. This effect is less than significant.*

As described above for Alternatives 1 and 2, the project now incorporates a Seepage Monitoring and Control Program as an environmental commitment to determine seepage flow rates, collect excess seepage, and maintain acceptable seepage rates and quantities over the life of the project. Under Alternative 3, this program would be expanded to control seepage on Bouldin Island and Holland Tract in addition to the Reservoir Islands. Under Alternative 3, all four project islands would be designed to include a core trench and interceptor well system to provide a levee seepage barrier, and additional piezometers would be installed in locations that are adjacent to Bouldin Island Holland Tract, in addition to the Reservoir Islands. Final levee designs are subject to engineering review before construction. Therefore, this effect is **less than significant**.

Mitigation Measure: No mitigation is required.

EFFECT FM-3 **Potential for Wind and Wave Erosion on Reservoir Islands.** *The proposed levee improvements incorporate features designed to withstand wind and wave erosion. This effect is less than significant.*

Implementation of Alternative 3 could result in wind and wave erosion of the interior levee slopes of perimeter levees on both the Reservoir Islands and Habitat Islands because of the long wind fetch across the islands and the water depths during water storage. However, the proposed island levee improvements incorporate features designed to withstand wind and wave erosion. Appropriate levee heights have been determined to accommodate expected wave heights, and rock revetment has been designed to dissipate wave energy and counteract erosive forces. Therefore, this effect is **less than significant**.

Mitigation Measure: No mitigation is required.

EFFECT FM-4 **Potential for Erosion of Levee Toe Berms at Pump Stations and Siphon Stations on Reservoir Islands.** *The proposed levee improvements have been designed to reduce erosion. This effect is less than significant.*

Implementation of Alternative 3 would not cause substantial levee toe erosion at siphon and pump stations on interior or exterior levee slopes on either the Reservoir or Habitat Islands. Pump and siphon units would be equipped with expansion chambers, which reduce flow through dissipation, and routine inspection and maintenance of the levees would identify any erosion problems and include implementation of erosion control measures as needed. Levee design for both the Reservoir Islands and the Habitat Islands under Alternative 3 would further reduce erosion potential through placement of revetment and erosion countermeasures that are typical for Delta islands and are easily maintainable over the life of the project. Therefore, this effect is **less than significant**.

Mitigation Measure: No mitigation is required.

EFFECT FM-5 **Change in Potential for Levee Failure on Project Islands During Seismic Activity.** *The proposed levee improvements would increase levee stability during seismic activity. This effect is less than significant.*

As described above for Alternatives 1 and 2, the proposed design under Alternative 3 for all four project island levees would meet or exceed PL84-99 levee geometry criteria, creating a wider and more stable levee mass that exceeds the existing levee geometry on any of the project islands. The project therefore would reduce the potential for levee failure on project islands during seismic activity as described in the Hultgren-Tillis (2009b) report. The proposed design would undergo necessary engineering review required by County planning agencies. The project also incorporates the environmental commitments described earlier this section, which include a Reservoir Island review, monitoring, and action board; implementation of an improved project levee design; and implementation of a Seepage Monitoring and Control Program, all of which would help to improve levee stability over existing conditions. Thus, project implementation would result in more stable levees on all four islands during seismic activity than would exist without the implementation of the project. Therefore, this effect is **less than significant**.

Mitigation Measure: No mitigation is required.

Table 3.9-1
Comparison of Delta Wetlands Project 2001 FEIS and this SEIS Effects and Mitigation Measures for Floodplain Management

2001 FEIS Effects and Mitigation Measures	SEIS Effects and Mitigation Measures
Alternatives 1 and 2 (Proposed Action)	
Impact D-1: Change in Long-Term Levee Stability on Reservoir Islands (LTS-M) **Mitigation Measure RD-1:** Adopt Final Levee Design That Achieves Recommended Factor of Safety and Reduces Risk of Catastrophic Levee Failure	**Effect FM-1:** Improvement in Long-Term Levee Stability on Reservoir Islands (LTS) **Mitigation:** No mitigation is required. Mitigation is no longer required because Reservoir Island levees will now be designed to exceed PL84-99 standards and final levee designs are subject to engineering review before construction.
Impact D-2: Potential for Seepage from Reservoir Islands to Adjacent Islands (LTS-M) **Mitigation Measure RD-2:** Modify Seepage Monitoring Program and Seepage Performance Standards	**Effect FM-2:** Potential for Seepage from Reservoir Islands to Adjacent Islands (LTS) **Mitigation:** No mitigation is required. The changes recommended in Mitigation Measure RD-2 in the 2001 FEIS have since been incorporated into the Seepage Monitoring and Control, and therefore mitigation is no longer necessary.
Impact D-3: Potential for Wind and Wave Erosion on Reservoir Islands (LTS) **Mitigation:** No mitigation is required.	**Effect FM-3:** Potential for Wind and Wave Erosion on Reservoir Islands (LTS) **Mitigation:** No mitigation is required. No change.
Impact D-4: Potential for Erosion of Levee Toe Berms at Pump Stations and Siphon Stations on Reservoir Islands (LTS) **Mitigation:** No mitigation is required.	**Effect FM-4:** Potential for Erosion of Levee Toe Berms at Pump Stations and Siphon Stations on Reservoir Islands (LTS) **Mitigation:** No mitigation is required. No change.
Impact D-5: Change in Potential for Levee Failure on Project Islands During Seismic Activity (LTS-M) **Mitigation Measure RD-1:** Adopt Final Levee Design That Achieves Recommended Factor of Safety and Reduces Risk of Catastrophic Levee Failure	**Effect FM-5:** Change in Potential for Levee Failure on Project Islands during Seismic Activity (LTS) **Mitigation:** No mitigation is required. Mitigation is no longer requested because levees will now be designed to PL84-99 standards and are subject to engineering review before construction.
Impact D-6: Increase in Long-Term Levee Stability on Habitat Islands (B) **Mitigation:** No mitigation is required.	**Effect FM-6:** Increase in Long-Term Levee Stability on Habitat Islands (B and LTS) **Mitigation:** No mitigation is required. The effect discussion has been expanded to discuss the additional benefits of the proposed levee design.
Alternative 3	
Impact D-7: Change in Long-Term Levee Stability on Reservoir Islands (LTS-M) **Mitigation Measure RD-1:** Adopt Final Levee Design that Achieves Recommended Factor of Safety and Reduces the Risk of Catastrophic Levee Failure	**Effect FM-1:** Improvement in Long-Term Levee Stability on Reservoir Islands (LTS) **Mitigation:** No mitigation is required. Mitigation is no longer required because Reservoir Island levees will now be designed to exceed PL84-99 standards and final levee designs are subject to engineering review before construction.

Table 3.9-1 **Comparison of Delta Wetlands Project 2001 FEIS and this SEIS Effects and Mitigation Measures for Floodplain Management**	
2001 FEIS Effects and Mitigation Measures	SEIS Effects and Mitigation Measures
Impact D-8: Potential for Seepage from Reservoir Islands to Adjacent Islands (LTS-M) **Mitigation Measure RD-2:** Modify Seepage Monitoring Program and Seepage Performance Standards	**Effect FM-2:** Potential for Seepage from Reservoir Islands to Adjacent Islands (LTS) **Mitigation:** No mitigation is required. The changes recommended in Mitigation Measure RD-2 in the 2001 FEIS have since been incorporated into the Seepage Monitoring and Control, and therefore mitigation is no longer necessary.
Impact D-9: Potential for Wind and Wave Erosion on Reservoir Islands (LTS) **Mitigation:** No mitigation is required.	**Effect FM-3:** Potential for Wind and Wave Erosion on Reservoir Islands (LTS) **Mitigation:** No mitigation is required. No change.
Impact D-10: Potential for Erosion of Levee Toe Berms at Pump Stations and Siphon Stations on Reservoir Islands (LTS) **Mitigation:** No mitigation is required.	**Effect FM-4:** Potential for Erosion of Levee Toe Berms at Pump Stations and Siphon Stations on Reservoir Islands (LTS) **Mitigation:** No mitigation is required. No change.
Impact D-11: Change in Potential for Levee Failure on DW project Islands during Seismic (LTS-M) **Mitigation Measure RD-1:** Adopt Final Levee Design that Achieves Recommended Factor of Safety and Reduces the Risk of Catastrophic Levee Failure	**Effect FM-5:** Change in Potential for Levee Failure on Project Islands during Seismic Activity (LTS) **Mitigation:** No mitigation is required. Mitigation is no longer requested because levees will now be designed to PL84-99 standards and are subject to engineering review before construction.

Notes: Shading denotes changes in the effect, significance conclusion, or mitigation measure from the 2001 FEIS; LTS = Less than significant; LTS-M = Less than significant with mitigation; B = Beneficial

Sources: ICF 2010:4.3-2 through 4.3-4 and AECOM 2013

3.9.6 Secondary and Cumulative Impacts

Secondary and cumulative effects related to floodplain management from implementing the project were described in the 2001 FEIS (Chapter 3D) and the 2010 DEIR (Chapter 5). The 2001 FEIS and 2010 DEIR are herein incorporated by reference, and the effects conclusions and mitigation measures, along with any changes, are summarized briefly below and shown in Table 3.9-2.

Decrease in Cumulative Flood Hazard in the Delta

Implementation of the Delta Wetlands project and the related projects considered in this cumulative analysis would cause a decrease in cumulative flood hazard within the Delta. Other projects that have the potential to alter flood hydrology or alter levee stability are proposing to do so with the intent of reducing flood hazards. The proposed levee geometry on the four project island levees would improve their general stability and improve their potential to provide necessary flood control. Project implementation would increase the levee mass, decrease the internal levee seepage potential, provide improved erosion protection, and maintain levee top widths and heights in accordance with PL84-99, which exceeds the existing condition of the current levees.

Through increased stability of the project islands, the Delta levee system would benefit from an overall improvement and reduced risk of potential levee failure on the four project islands to adversely affect the stability of an adjacent island levee (i.e., levee failure of a project island directing flood flow at an adjacent island levee). Furthermore, the potential exists for the project islands to provide flood pressure relief on the Delta levee system by storing floodwaters and contributing to flood stage reduction if storage exists during times of Delta flooding. This cumulative effect is beneficial.

Decrease in the Need for Public Financing of Levee Maintenance and Repair on the Project Islands

Project implementation would likely reduce the need for public financing of levee maintenance and repair on the project islands. Savings at the state and Federal level would result from project implementation because the risk of levee failure would be reduced, and therefore the cost of reclamation would be much lower than in the case of existing levees. This cumulative effect is beneficial.

Table 3.9-2
Comparison of Cumulative Floodplain Management Effects between the 2001 FEIS and this SEIS

2001 FEIS Cumulative Effects and Mitigation Measures	SEIS Cumulative Effects and Mitigation Measures
Impact D-12: Decrease in Cumulative Flood Hazard in the Delta (B) **Mitigation:** No mitigation is necessary.	Decrease in Cumulative Flood Hazard in the Delta (B) **Mitigation:** No mitigation is necessary. No change.
Impact D-13: Decrease in the Need for Public Financing of Levee Maintenance and Repair on the DW project islands (B) **Mitigation:** No mitigation is necessary.	Decrease in the Need for Public Financing of Levee Maintenance and Repair on the project islands (B) **Mitigation:** No mitigation is necessary. No change.

Note: B = Beneficial

Sources: ICF 2010:5-31 through 5-32 and AECOM 2013

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3.10 HAZARDOUS WASTE AND MATERIALS

3.10.1 INTRODUCTION

This section describes recent changes to the existing environmental conditions and regulatory framework/applicable laws, regulations, plans, and policies of the project study area, summarizes the unchanged affected environment, and describes changed environmental effects for hazardous waste and materials, including public health, for the project. A review and update of the 1995 DEIR/EIS assessment related to public health, and the assessment related to hazardous waste and materials effects on water quality, were incorporated in the 2001 FEIS. Chapters 3C and 3M in the 2001 FEIS provided detailed information regarding water quality effects from hazardous waste and materials, and public health effects from vector-borne diseases, associated with the project and in the Sacramento-San Joaquin Delta (Delta) in general. These effects were analyzed most recently in Sections 4.2, 4.11, and Chapter 5 of the 2010 DEIR, which also served as a basis for this analysis. The 1995 DEIR/EIS, 2001 FEIS, and 2010 DEIR are herein incorporated by reference.

The 2001 FEIS concluded that the project alternatives would affect public health on and in the vicinity of the four project islands. The 2001 FEIS also concluded that the project alternatives could affect water quality if hazardous wastes or materials were mobilized into Delta channels during construction or operation. Since that time, there have been minor changes in the “Affected Environment” and “Regulatory Framework/Applicable Laws, Regulations, Plans, and Policies” subsections. However, there have been no changes in the project that result in new significant environmental effects or a substantial increase in the severity or intensity of previously identified significant effects related to hazardous waste and materials, including public health.

The 2001 FEIS “Mosquitoes and Public Health” analysis has been updated here to reflect current environmental conditions on and around the project islands. Information regarding mosquito breeding conditions and mosquito abatement activities on the project islands has been updated, and a discussion of West Nile virus, which has emerged as a public health risk since the publication of the 2001 FEIS, has been added. In addition, Mitigation Measure HZ-1 has been updated to reflect guidelines for design and management of constructed wetlands recently published by the Central Valley Joint Venture, California Department of Health Services, and Sacramento-Yolo Mosquito and Vector Control District. These changes are minor and do not affect the results of the analysis reported in the 2001 FEIS.

Identification of the project’s specific places of use as part of the affected environment does not affect hazardous waste and materials or public health in any way that alters the conclusions of the 2001 FEIS. The project would not have any direct effects on hazardous waste and materials or public health in the places of use; the effects on hazardous waste and materials and public health, if any, associated with the provision of project water to the places of use are addressed in the “Secondary and Cumulative Effects” subsection below and in Chapter 4, “Other Statutory Requirements.”

SUMMARY OF CHANGES, NEW CIRCUMSTANCES, AND NEW INFORMATION

Substantial Changes in the Project

Since the 2001 FEIS was completed, there have been no substantial changes in the project resulting in new significant adverse effects or substantial increase in the severity or intensity of hazardous waste and materials effects related to hazardous waste and materials or public health. However, the project no longer includes a proposal to construct new recreation facilities on the Reservoir or Habitat Islands; this change to the project results in a reduction and/or elimination of some the previously identified environmental effects.

New Circumstances

New circumstances pertinent to the public health analysis are related to the advent of West Nile virus as a human health risk and changed conditions on and around the project islands, and are described below.

West Nile Virus

Since the 2001 FEIS, West Nile virus has emerged as a public health risk in the project area. This mosquito-borne disease has sickened approximately 3,625 humans, led to the death of approximately 129 humans in California since 2003 (California Department of Public Health 2013), and caused increased mosquito abatement activities throughout the state.

West Nile virus is now well established in all 58 counties of California. West Nile virus is a disease transmitted to humans, birds, horses, and other animals by infected mosquitoes. Mosquitoes get the disease from infected birds while taking blood, and can later transmit it when they bite humans or other animals. West Nile virus can cause encephalitis in humans. Most infections are mild, with flu-like symptoms. Severe infections may include neck stiffness, disorientation, coma, tremors, convulsions, muscle weakness, paralysis, and rarely, death. From 2003 through 2011, 38 human cases of West Nile virus were reported in Contra Costa County and 87 cases were reported in San Joaquin County (California Department of Public Health 2011).

The advent of West Nile virus as a public health risk has affected the programs and operations of local mosquito and vector control districts (MVCDs). Tolerance thresholds for mosquitoes in populated areas are substantially lower, having been reduced in recent years by almost one-half (Sanabria pers. comm.). The threat of West Nile virus has triggered MVCDs to increase surveillance, trapping, and adulticide application programs (Sanabria and Lucchesi pers. comm.). MVCDs in the Delta now have a heightened concern about two mosquito species in particular that are the chief vectors for West Nile virus in the Delta: *Culex pipiens* and *Culex tarsalis* (Lucchesi pers. comm.). Breeding conditions and other information for these species were described in the 2001 FEIS and are herein incorporated by reference.

Changes in Mosquito Breeding Habitat and Mosquito Abatement Activities

The 2001 FEIS used 1988 conditions to describe baseline conditions on and around the project islands and to analyze the project’s effects on public health. Mosquito habitat conditions and, consequently, mosquito abatement activities on some of the project islands have changed since the publication of the 2001 FEIS. This is primarily because cropping and land use patterns on the project islands have changed. A summary of mosquito breeding conditions and abatement activities undertaken on each project island in 2008 by the Contra Costa County and San Joaquin County MVCDs are described in the “Affected Environment” section below. Because cropping and land use patterns on the project islands are essentially the same today (in 2013) as they were in 2008, this information is still valid.

Conditions in the areas around the project islands also have changed since the 2001 FEIS. Population in the secondary zone of the Delta has increased substantially over the past 20 years, and new residential development has placed more humans within the range of mosquitoes originating on the project islands. For example, the City of Brentwood’s population increased from an estimated 7,563 to 51,481 between 1990 and 2010 (California Department of Finance 2013). Much of the City of Brentwood is located within 5 miles of Holland Tract—5 miles being the distance some mosquitoes are able to travel from production areas.

New Information

There is no new information of substantial importance that would result in an increase in severity or intensity of hazardous waste and materials or public health effects. However, since the publication of the 2001 FEIS, new information and methods have been developed for mosquito management in constructed wetlands.
Public attitudes about wetlands have changed greatly in the last few decades, shifting from viewing wetlands as wasted land that should be reclaimed for commercial uses to recognizing the value of wetlands for habitat, recreational opportunities, and the benefits they provide in terms of flood control, water filtration, and groundwater recharge. This has led to an increase in managed wetlands projects throughout California. To address public health concerns about mosquito production in these managed wetlands, several groups have developed guides and habitat management strategies to reduce mosquito production in managed wetlands, and to facilitate

greater cooperation among wetland habitat managers and MVCDs. MVCDs now are encouraging “integrated pest management” (IpM), which incorporates multiple strategies to achieve effective control of mosquitoes. These strategies consist of:

- source reduction—designing wetlands and operations to be inhospitable to mosquitoes;
- monitoring—implementing monitoring and sampling programs to detect early signs of mosquito population problems;
- biological control—use of biological agents such as mosquitofish to limit larval mosquito populations;
- chemical control—larvicides and adulticides; and
- cultural control—changing the behavior of people so their actions prevent the development of mosquitoes or the transmission of vector-borne disease.

Mitigation Measure HZ-1 has been updated pursuant to current IpM practices and calls for modifications to the proposed Compensatory Mitigation Plan (CMP) in coordination with the Contra Costa County Mosquito and Vector Control District (CCCMVCD) and the San Joaquin County Mosquito and Vector Control District (SJCMVCD). The key sources of new information pertaining to mosquito management strategies used in the update of Mitigation Measure HZ-1 consist of:

- *Guidelines for Wetland Development*, Central Valley Joint Venture (Kwasny et al. 2004);
- *Best Management Practices for Mosquito Control on California State Properties* (California Department of Public Health 2008); and
- *Best Management Practices for Mosquito Control in California* (California Department of Public Health and Mosquito and Vector Control Association of California 2010).

SUMMARY OF ENVIRONMENTAL COMMITMENTS

Environmental commitments are measures incorporated by the project applicant as part of the project, meaning they are proposed as elements of the Proposed Action and are therefore considered in conducting the environmental analysis for each resource area of this SEIS. The purpose of environmental commitments is to reflect and incorporate best practices into the project that avoid, minimize, reduce, or offset potential adverse environmental effects. A complete description of the environmental commitments that have been incorporated into the project since the 2001 FEIS is contained in Chapter 2, “Project Description and Alternatives” of this SEIS. There are no environmental commitments that would affect the analysis or effect conclusions related to hazardous waste and materials.

3.10.2 AFFECTED ENVIRONMENT

Existing conditions related to hazardous materials are the same as they were presented in the 2001 FEIS Chapter 3C, and are herein incorporated by reference. A summary of existing hazardous materials conditions is provided below. Existing public health conditions are, for the most part, the same as they were presented in the 2001 FEIS Chapter 3N and are herein incorporated by reference. However, some changes in mosquito breeding habitat have occurred on the project islands. The majority of changed conditions in mosquito breeding habitat and abatement activities on the project islands are attributable to changed cropping patterns (as different crops require varying amounts of water at different times of the year). An update of mosquito breeding conditions on the project islands is provided below (see also Tables 3.2-1 and 3.2-2 in Section 3.2, “Agricultural Resources” for details on current crop information).

HAZARDOUS MATERIALS ON THE PROJECT ISLANDS

As discussed in the 2001 FEIS, residues from pesticides, trace metal compounds, and other agricultural or industrial chemicals may produce pollution conditions in Delta water and may bioaccumulate Delta fish and other aquatic organisms. Because the project entails flooding of the project islands for water storage, there is a potential that stored water could became contaminated as a result of mobilization of existing soil pollutants, and then convey those pollutants into Delta channels when the stored water is released. Therefore, the potential that the project islands may contain harmful pollutants was investigated as part of the project. Appendix C6 to Volume 2 of the 1995 DEIR/DEIS, entitled "Assessment of Potential Water Contaminants on the Delta Wetlands Project Islands" (herein incorporated by reference), describes the results of soil sampling and laboratory analyses for pesticide residues. The results indicate that in general, the project islands do not contain concentrations of agricultural chemicals at a level that would pose a concern for this project. Pesticide residues were low to nondetectable for chemicals that are known to have a high potential to leach from the soil. Because agricultural activities on the project islands have not substantially changed since the sampling was performed, the same conclusions would apply today. Detected residues from one soil sample on Bacon Island were high because herbicides had been recently applied before the samples were taken. However, the herbicides used on the project islands undergo rapid chemical degradation and therefore would not pose a hazard for the proposed water storage. Other potential sources of water pollutants associated with hazardous materials on the project islands were described in the 2001 FEIS and are summarized below and shown in Exhibit 3.10-1.

Bacon Island

Bacon Island is the most densely populated of the project islands. Most of the domestic wastewater from homes and farm worker housing is disposed of by on-site septic systems. Prior to the institution of county or private garbage collections services, many farm operators disposed of domestic trash at selected locations on the island. Abandoned vehicles, used automobile tires, various containers, and common household or farm-related trash can be found at these sites (see Exhibit 10-1).

Bacon Island has several permanent farm operation facilities, with designated areas for maintenance and repair of farm machinery. Fugitive diesel fuel and gear and motor oil drippings are evident in the soils in most of these areas. Used oils are stored in aboveground containers and are collected by a waste oil recycler as necessary. Partially filled or empty pesticide containers are stored in structures at selected sites on Bacon Island (see Exhibit 3.10-1). Most of these structures are elevated above the ground surface and thus contamination of the ground surface is unlikely. Storage, transportation, and disposal of pesticides are regulated by the California Department of Department of Pesticide Regulation, as set forth in the California Code of Regulations Division 6, Article 4, Chapter 3.

A discontinued copper salvaging operation is located at the northwestern corner of Bacon Island (see Exhibit 3.10-1). A hazardous waste investigation and subsequent site cleanup activities were conducted on that site, and high levels of copper, zinc, lead, and other heavy metals were detected in soils surrounding the site. Levels of copper and lead were found to exceed hazardous waste criteria established by the California Department of Public Health (formerly California Department of Health Services [DHS]). Soils were also tested for U.S. Environmental Protection Agency (EPA) priority pollutants, most of which are synthetic organic compounds; all constituents were below the detection limits. DHS subsequently issued a letter stating that cleanup activities were adequate and all constituents of concern were present at background levels (ICF 2001:3C-13).

Webb Tract

Historically few people have lived on Webb Tract and the potential for the presence of major deposits is therefore low. No indications of domestic garbage sites were observed on Webb Tract during field visits to Webb Tract. A few farmers live in small mobile homes during the growing season. Users of the few permanent structures on the island rely on on-site septic systems for sewage disposal. Few farm machine repair or pesticide storage areas are located on the island.

Bouldin Island

No visible signs of waste dumping have been observed during field visits to Bouldin Island. All homes and office buildings on Bouldin Island employ on-site septic systems for domestic sewage disposal. Domestic trash is transported off the island by a certified waste disposal firm. There are farm machinery repair facilities on the eastern end of the island, approximately 1/2-mile south of the State Route (SR) 12 bridge at Terminous (ICF 2001:3C-13). Oil and grease drippings are evident in localized areas of the repair facilities.

Pesticide storage areas are absent from Bouldin Island because of the island's proximity to the Stockton-Lodi area, where major agricultural chemical distributors are located. Because pesticide formulations are mixed at distributors' warehouses, minimal on-site storage or mixing is required (ICF 2001:3C-14). Most farmers use the same chemical distributor each year and through experience know the quantities of compounded needed to minimize waste and overuse. Additionally, many of the compounds are aerially applied; chemicals are handled and loaded at Bouldin Island airstrip.

Holland Tract

Domestic garbage dumps have not been observed on Holland Tract. Few people live on the island; most visitors to Holland Tract are boaters with berthing leases at the marinas (ICF 2001:3C-14). Trash generated at the marinas is collected by a private waste hauling firm. No signs of pesticide storage areas were identified on Holland Tract during numerous field visits.

From 1979 to 1993, several landowners used Holland Tract land to spread paper pulp waste produced by the Gaylord Container Corporation's paper recycling facility in Antioch. The pulp waste was a byproduct of recycled corrugated cardboard. The waste disposed of on the island consisted of short paper fibers, minor amounts of plastic, and adhesive compounds. Approximately 450 tons per day of wet material was delivered to the island, where it was stockpiled and allowed to dry. Approximately 80% of the material consisted of water, while only 20% (i.e., 90 tons per day) was pulp waste. Beginning in approximately 1987, the materials were disked or plowed into the soil to improve the soil's percolation and water-retention capabilities (ICF 2001:3C-14).

The pulp waste was disposed of under a permit issued by the Contra Costa County Planning Department (Permit 2127). In compliance with permit requirements, two, 4-inch-diameter groundwater monitoring wells approximately 30 feet deep were installed. Quarterly reports were provided to the Contra Costa Water District (CCWD). In 1984, monitoring was discontinued after one well was accidentally destroyed by a bulldozer.

A chemical analysis of the waste pulp was conducted for CCWD in 1988 (ICF 2001:3C-14). As part of the laboratory analysis, 27 trace metals were analyzed but none were found at levels that exceeded DHS criteria. Organic compounds were also not detected. Additional data collected and analyzed in 1989 confirmed that metal concentrations were similar to background soil concentrations (ICF 2001:3C-14). After reviewing the results of the laboratory analyses, the Central Valley Regional Water Quality Control Board indicated that metal concentrations in pulp wastes do not represent a potential threat to surface or groundwater quality (ICF 2001:3C-14).

AIR TRAFFIC

A small private airstrip is located on the east side of Bouldin Island, south of SR 12, and runs generally east to west. The airstrip is used primarily for agricultural activities (crop dusting) on Bouldin Island, Holland Tract, and Webb Tract. A similar airstrip also exists on the eastern edge of Bacon Island (Delta Protection Commission 2001: 5, 6).

MOSQUITOES AND MOSQUITO BREEDING HABITAT

Bacon Island

Bacon Island continues to be intensively farmed, but cropping patterns have changed since 1988. Alfalfa, corn, and wheat made up nearly 90% of the crops grown on Bacon Island in 2008. Potatoes are no longer grown or processed on the island. In 1988, the production of seed potatoes on Bacon Island accounted for 52.5% of San Joaquin County's production of the crop, and the ponds receiving tailwater from potato processing were regularly treated for mosquito production by the SJCMVCD. However, seed potatoes have not been produced on Bacon Island since 2003, and the SJCMVCD no longer needs to treat the potato processing tailwater ponds as regularly for mosquitoes, although the ponds still exist and occasionally produce mosquito populations (Lucchesi pers. comm.).

As described in the 2001 FEIS, the SJCMVCD still receives occasional service requests from the resorts around Bacon Island. However, the SJCMVCD does not consider Bacon Island a problem mosquito production area because the island is managed for agricultural production and water is not used in a way that normally causes mosquito breeding (Lucchesi pers. comm.).

Webb Tract

Corn production on Webb Tract has nearly doubled since 1988. In 2008, 98% of the agricultural land on Webb Tract was planted in corn. During the winter months, fields on Webb Tract are flooded for duck habitat. However, the CCCMVCD still does not consider Webb Tract a problem mosquito source because the land manager takes precautions to minimize mosquito breeding habitat, like tilling the soil before flooding, which eliminates many of the conditions conducive to mosquito production. The CCCMVCD has a collaborative relationship with the land managers and is consulted regularly on how and when the fields are flooded. Webb Tract was inspected by the CCCMVCD 53 times in 2008, and required only one mosquito control treatment (Sanabria pers. comm.).

Bouldin Island

The majority of Bouldin Island is farmed for corn and rice. These two crops accounted for nearly 77% of the island's agricultural acreage in 2008. The acreage devoted to corn production has almost doubled since 1988, and rice is a new crop on the island since that time. The rice fields require surveillance and subsequent treatment for mosquito production approximately six times per year (Lucchesi pers. comm.).

After harvest, the corn fields on Bouldin Island are flooded to attract migrating waterfowl. The corn stubble that is left in the fields after harvest can start to decay after flooding if the weather is still hot. This causes the water to become anaerobic and serve as good mosquito breeding habitat. The SJCMVCD works with the land managers on Bouldin Island to postpone the introduction of floodwater until late October to avoid prime mosquito breeding conditions.

The SJCMVCD still receives occasional service requests from the resorts around Bouldin Island. However, because the SJCMVCD has a cooperative working relationship with the land managers, and because the rice and corn fields are managed for agricultural production, mosquito treatment on Bouldin Island is predictable. The SJCMVCD does not consider Bouldin Island a problem mosquito production source (Lucchesi pers. comm.).

Holland Tract

Since 1988, all agricultural land on Holland Tract has been converted to pasture; corn and wheat are no longer grown on the island. During the period of 2002–2008, 2,884 acres of Holland Tract were used for pasture each year, an equivalent of approximately 60% of the island's total acreage; none of the island was used for crop production during this period (Delta Wetlands Properties 2008).

The CCCMVCD still considers certain areas of Holland Tract to be problem mosquito production areas, though the major problem areas on the island are not under project applicant ownership. The CCCMVCD performs some mosquito abatement activities on land owned by the project applicant, but does not consider those lands to be a problem mosquito source because the project applicant collaborates with the CCCMVCD on timing and duration of flooding activities (Sanabria pers. comm.).

Other areas of Holland Tract produce problem numbers of mosquitoes, mainly because of the large amount of irrigated, non-leveled pasture. Non-leveled pastures can trap and hold water in depressions for long enough periods of time to create favorable mosquito breeding conditions. There is also a duck club on Holland Tract with very rudimentary flooding infrastructure that is occasionally a problem mosquito source area. Mosquitoes originating on Holland Tract have caused problems for residents of Bethel Island to the north of Holland Tract and for residents of Oakley to the west of Holland Tract. From January 1, 2008 through July 15, 2009, the CCCMVCD received 191 service request calls from locations within a 5-mile radius of Holland Tract (Sanabria pers. comm.). The increase in service calls over 2001 numbers is likely due to population growth in adjacent areas described in the "New Circumstances" subsection above.

3.10.3 Regulatory Framework/Applicable Laws, Regulations, Plans, and Policies

Federal applicable laws and regulations are provided because they are required under NEPA. State applicable laws and regulations are provided for informational purposes and to assist with NEPA review. USACE has considered applicable state, regional, and local plans and ordinances as a part of the environmental review process for this SEIS, where applicable.

Federal

Hazardous Materials Handling

At the Federal level, the principal agency regulating the generation, transport, and disposal of hazardous substances is EPA, under the authority of the Resource Conservation and Recovery Act (RCRA). RCRA established an all-encompassing Federal regulatory program for hazardous substances that is administered by EPA. Under RCRA, EPA regulates the generation, transportation, treatment, storage, and disposal of hazardous substances. RCRA was amended in 1984 by the Hazardous and Solid Waste Amendments of 1984 (HSWA), which specifically prohibits the use of certain techniques for the disposal of various hazardous substances. The Federal Emergency Planning and Community Right to Know Act of 1986 imposes hazardous-materials planning requirements to help protect local communities in the event of accidental release of hazardous substances. EPA has authorized the State of California to implement the Federal RCRA in California, based on the determination that California's Code of Regulations (Title 22, Division 4.5) contains the Federal hazardous waste regulations (RCRA regulations). The California Department of Toxic Substances is responsible for implementing Title 22.

Worker Safety Requirements

The Occupational Safety and Health Administration (OSHA) is responsible at the Federal level for ensuring worker safety. OSHA sets Federal standards for implementation of workplace training, exposure limits, and safety procedures for the handling of hazardous substances (as well as other hazards). OSHA also establishes criteria by which each state can implement its own health and safety program.

There are no Federal laws, regulations, plans, or policies that apply to public health concerns related to vector-borne diseases on the Project Islands.

STATE

There are no state laws, regulations, plans, or policies related to hazardous waste and materials that would apply to the Proposed Action or the alternatives under consideration.

Mosquito and vector control districts are local agencies. Bouldin and Bacon Islands are within the jurisdiction of SJCMVCD, and Holland and Webb Tracts are within the jurisdiction of CCCMVCD.
Applicable laws, regulations, plans, or policies that apply to water quality are presented in Section 3.11, “Hydrology and Water Quality.”

3.10.4 ANALYSIS METHODOLOGY

Proposed management of the Reservoir Islands and creation of wetland, pasture, and cornfield habitats on the Habitat Islands may increase or decrease the amount of potential breeding habitat for mosquitoes, wildlife-borne diseases, or other pests. Changes in the timing of water application and withdrawal on the project islands may increase or decrease the amount of potential breeding habitat for mosquitoes or other pests. Changes in land and water management may increase the presence of wildlife species, particularly migratory waterfowl, that are hosts for transmittable diseases.

The following were considered with regards to potential mosquito breeding conditions and abatement requirements for the project islands:

- literature on mosquito ecology and control methods;
- contacts with SYMVCD and CCCMVCD personnel; and
- information on acreages of habitat types and flood conditions to be created on the project islands.

In the analysis, the growing season for vegetation and the breeding periods for mosquitoes were assumed to extend from May through October (Lucchesi pers. comm.). Additionally, predictions of the frequency and extent of water storage, nonstorage, and shallow-flooding conditions on the Reservoir Islands under the project alternatives were considered. Prediction of future conditions on a particular Reservoir Island must consider that the Reservoir Islands may be sequentially filled and, when feasible, rotate the sequence of island flooding between years to maximize the opportunity for creating shallow-water wetland habitats (see Chapter 2, “Project Description and Alternatives”). Alternatively, the Reservoir Islands may be simultaneously filled when water is available for diversion onto both islands. The analysis of mosquito breeding conditions assumes that the Reservoir Islands would be sequentially filled to provide the greatest opportunity to create shallow-water wetlands and thus, as a worst-case scenario, the greatest potential for creating mosquito breeding habitat. In the assumed order of sequential filling for Alternatives 1 and 2, Bacon Island (having the greatest storage capacity) would be filled to capacity before water is diverted to Webb Tract, and Webb Tract would be emptied before water is released from Bacon Island. Under Alternative 3, the order of diversion would be Bacon Island, Webb Tract, Bouldin Island, and Holland Tract; these islands would be emptied in the reverse order.

The analysis of potential effects from hazardous waste and materials considered the previous soil sampling, results of laboratory and field investigations, and the potential that water storage could mobilize pollutants presently located in the soil and thereby contaminate Delta waters when the water is released from the project islands. Numeric water quality standards and regulations are discussed in detail in Section 3.11, “Hydrology and Water Quality.”

SIGNIFICANCE CRITERIA

The basis for determining the significance of effects for this analysis is based on professional standards, project-specific criteria developed by the lead agency to address potential effects unique to the project’s location and elements, and is informed by the criteria contained in the Environmental Checklist in Appendix G of the State CEQA Guidelines. These thresholds encompass the factors taken into account under NEPA to determine the significance of an action in terms of its context and the intensity of its effects. The Proposed Action or alternatives under consideration would have a significant, adverse effect on aesthetics if they would do any of the following:

- cause known, existing hazardous wastes in the soil on project islands to substantially degrade water quality through the release of water stored on the islands;
- result in a safety hazard for people residing or working in the vicinity of a private airstrip;
- project-related activities or changes to habitat that necessitated increased levels of mosquito abatement programs compared to existing conditions in order to maintain mosquito populations at pre-project levels. Habitat changes that could result in a substantial decline of available mosquito breeding habitat or greater efficiency of mosquito and vector control district abatement programs are considered to be beneficial effects; or
- substantially increase the potential exposure of people to wildlife-transmitted diseases that are considered a high health risk in the Delta area by the California Department of Public Health.

3.10.5 ENVIRONMENTAL CONSEQUENCES AND MITIGATION MEASURES

EFFECTS ANALYSIS

The hazardous waste and materials effects related to hazardous waste and materials and to public health resulting from implementation of the project were described in detail in the 2001 FEIS (Chapters 3C and 3M) and are briefly summarized in Table 3.10-1. Where there have been no changes to the effect analysis, the 2001 FEIS is herein incorporated by reference.

No-Action Alternative

EFFECT HZ-1 Potential Contamination of Stored Water by Contaminant Residues. *The proposed water storage facilities would not be constructed and thus there would be no mobilized contaminants to cause an adverse effect on Delta channel water quality from discharged water. No effect would occur.*

Under the No-Action Alternative, the project islands would not be used for water storage or for habitat mitigation. Instead, agricultural activities would continue. Because project islands would not be used for water storage, there would be **no effect** related to water contamination from mobilization of hazardous wastes in soils on the project islands.

EFFECT HZ-2 Contamination of Delta Water by Agricultural Pollutants. *Fertilizers and pesticides used on agricultural land could contaminate agricultural drainwater that returns to Delta channels. This effect is potentially significant.*

Under the No-Action Alternative, the project islands would continue to adversely affect water quality in the Delta by discharging agricultural drainage water. Agricultural drainage in the Delta contains traces of agricultural chemicals (e.g., pesticides), which can be harmful to aquatic life on a regional scale. Under the No-Action Alternative, increased agricultural activities would occur, likely increasing the amount of agricultural water discharged from the project islands into the Delta. This effect is **potentially significant.**

EFFECT HZ-3 Aircraft Safety Hazards. *The No-Action Alternative would not change operation of the airstrip or existing aircraft safety hazards. No effect would occur.*

Under the No-Action Alternative, the existing airstrip on Bouldin Island would continue to operate as it does now. This is a small, private airstrip operated for planes performing aerial application of herbicides, pesticides, and fertilizers, and it provides access to the island for property owners. No known aircraft safety hazards currently exist. **No effect** would occur.

EFFECT HZ-4 Change in Mosquito Abatement Activities During Storage periods on the Reservoir Islands. *Because the proposed water storage facilities would not be constructed, and because a somewhat different mix of agricultural crops is anticipated under the No-Action Alternative, this effect is beneficial and less than significant.*

Under the No-Action Alternative, the project islands would not be used for water storage or for habitat mitigation. Instead, agricultural activities would continue. An increase in corn cultivation would occur on Holland and Webb Tracts. This could involve increased fall flooding to control weeds in the cornfields, which was considered in the 2001 FEIS to potentially result in increases in mosquito production. However, corn production has already doubled on the island, and no substantial increase in mosquito abatement activities has been necessary.

Under the No-Action Alternative, more intensive agricultural operations would be implemented on the four project islands. The No-Action Alternative would increase the acreage of land cultivated for annual grains, perennial crops, orchards, and vineyards and reduce the acreage of irrigated pasture and marsh habitats, which have the potential to produce problem numbers of mosquitoes. This would result in a reduction of existing mosquito breeding habitat and consequently, a reduction in mosquito abatement activities on the project islands. Therefore, this effect is **beneficial** and **less than significant**.

EFFECT HZ-5 Increase in Abatement Levels on the Habitat Islands and During Partial-Storage, Shallow-Storage, or Shallow Water-Wetland Periods on the Reservoir Islands. *Because the proposed water storage facilities would not be constructed, an associated increase in mosquito production would not take place, and no effect would occur.*

As discussed above under Effect HZ-4, under the No-Action Alternative, the Reservoir Islands would not be used for water storage and new wetland habitat would not be created on the Habitat Islands. Therefore, an increase in the need for mosquito abatement activities during shallow water-wetland periods on the project islands would not occur, and there would be **no effect**.

EFFECT HZ-6 Increase in Potential Exposure of People to Wildlife Species that Transmit Diseases. *Transmission of wildlife-transmitted diseases such as Lyme disease, bubonic plague, and rabies is not considered a substantial risk to public health in the Delta. This effect is less than significant.*

An intensive, for-fee hunting program would be implemented under the No-Action Alternative, generating an additional 12,000 hunter-use days per year. The presence of an increased number of hunters on the project islands is not anticipated to require increased mosquito abatement activities, as the hunting season does not generally coincide with mosquito season, and because mosquito production levels are anticipated to decline under the No-Action Alternative.

Populations of wildlife species that could transmit diseases to humans are not expected to increase under the No-Action Alternative. Increased agricultural production may reduce existing wildlife populations by disturbing or eliminating their habitats through plowing and removing vegetation. Therefore, implementing the No-project Alternative would not affect the incidence of wildlife-transmitted diseases affecting humans. This effect is **less than significant.**

Alternative 1 and Alternative 2 (Proposed Action)

Alternative 1 is very similar to Alternative 2, differing only with regard to operating criteria for diversion and discharge of stored water on the Reservoir Islands. The Reservoir Island operating criteria for Alternative 1 could lead to different frequencies of mosquito breeding habitat creation than under Alternative 2. The frequency with which mosquito breeding habitat would be created on Bacon Island probably would be decreased because partial-storage, shallow-storage, and shallow water-wetland periods would decrease. The frequency of these habitat conditions on Webb Tract probably would increase from May through August when the island could be managed for shallow-water wetlands, but would decrease during September and October. Although the frequency of creation of mosquito habitat could differ, effects and mitigation measures under Alternative 1 are generally the same as those under Alternative 2. Effects from hazardous wastes and materials would be the same under Alternatives 1 and 2. Therefore, they are described together under this heading.

EFFECT HZ-1 **Potential Contamination of Stored Water by Contaminant Residues.** *Water storage on the Reservoir Islands could mobilize soil contaminants from historical pollution sites. If the contaminant concentrations are high, mobilization of the dissolved fraction of the contaminants could cause an adverse effect on Delta channel water quality from discharged water. This effect is significant.*

As discussed in the 2001 FEIS, the results of laboratory analyses from soil sampling (Appendix C6 to the 1995 DEIR/DEIS, herein incorporated by reference) indicated that in general, project island soils do not contain substantial concentrations of agricultural chemicals. Exhibit 3.10-1 shows the location of potential contamination sites on Bacon Island and Holland Tract. The identified sites consisted of farm machinery repair facilities, pesticide storage areas, domestic waste dumps, and a copper salvaging site on Bacon Island; and historical pulp disposal areas on Holland Tract. No potential contamination sites were identified on Webb Tract or Bouldin Island. Water storage on Bacon Island could mobilize soil contaminants from historical pollution sites. If the contaminant concentrations are high, mobilization of the dissolved fraction of the contaminants could cause an adverse effect on Delta channel water quality from discharged water. This effect is **significant**.

Mitigation Measure HZ-MM-1: Conduct Assessments of Potential Contamination Sites and Remediate as Necessary.

The project applicant shall conduct site assessments at potential contamination sites, including sites associated with agricultural airstrip operations. If the results of a site assessment indicate that contamination is likely to mobilize into the stored water, the project applicant shall develop plans for site remediation. Such site assessments and remediation typically would be performed under the supervision of the Central Valley RWQCB. All required assessments and remediation shall be completed prior to the beginning of project water storage.

Implementing Mitigation Measure HZ-MM-1 would reduce this effect to a **less-than-significant** level because potential contamination sites would be assessed and remediated as necessary.

EFFECT HZ-2 **Reduction in Agricultural Pollutants.** *Fertilizers and pesticides currently used on agricultural land could contaminate agricultural drainwater that returns to Delta channels. Implementation of the project would have the beneficial effect of reducing these contaminants. This effect is beneficial and less than significant.*

Implementation of Alternatives 1 and 2 would result in more than a 14,000-acre reduction in harvested agricultural acres (see Table 3.2-2 in Section 3.2, "Agricultural Resources"). Fertilizers and pesticides currently used on this land can contaminate agricultural drainwater that returns to Delta channels. Since the land would be taken out of agricultural production, project implementation would have the **beneficial** effect of reducing these contaminants. This effect is **less than significant**.

Mitigation Measure: No mitigation is required.

EFFECT HZ-3 **Aircraft Safety Hazards.** *Project implementation would not substantially change operation of the airstrip or existing aircraft safety hazards. This effect is less than significant.*

Under Alternatives 1 or 2, the Bouldin Island airstrip would be available for project maintenance activities such as seed dispersal and application of herbicides and pesticides. The project's Draft CMP (see Appendix B) places restrictions on timing and frequency of takeoffs and landings from the airstrip during the waterfowl season (September 1 to March 31) to reduce disturbances to wildlife. During other times of the year, no restrictions would be placed on use of the airstrip. However, it is anticipated that use of the airstrip would average less than 10 takeoffs and landings throughout the year. Therefore, number of flights generated from the airstrip under Alternatives 1 or 2 would be less than current levels for agricultural activities. Implementing the project would not substantially change operation of the airstrip, and would not substantially change existing aircraft safety hazards. Therefore, this effect is **less than significant**.

Mitigation Measure: No mitigation is required.

EFFECT HZ-4 **Reduction or Elimination of Mosquito Abatement Activities During Full-Storage Periods on the Reservoir Islands.** *During full-storage periods, mosquito production on the Reservoir Islands would be minimal. Deep, open-water habitats are poor mosquito breeding areas because the wave action generated over large water bodies disrupts the ability of larvae to penetrate the water surface and because vegetation necessary for egg laying and cover for larvae is lacking. This effect is beneficial and less than significant.*

During full-storage periods, mosquito production on the Reservoir Islands would be minimal. At full storage, water depths would exceed 10 feet over most of the project islands and, because the water level would be at the riprapped levee slopes, reservoir edges would lack emergent vegetation that could be used as breeding areas by problem numbers of mosquitoes. Deep, open-water habitats are poor mosquito breeding areas because the wave action generated over large water bodies disrupts the ability of larvae to penetrate the water surface and because vegetation necessary for egg laying and cover for larvae is lacking. Implementation of Alternatives 1 and 2 would reduce mosquito production as compared to existing conditions and, subsequently, the need for abatement on the Reservoir Islands during full-storage periods. Therefore, this effect is **beneficial and less than significant**.

Mitigation Measure: No mitigation is required.

EFFECT HZ-5 **Increase in Abatement Levels on the Habitat Islands and During Partial-Storage, Shallow-Storage, or Shallow Water-Wetland Periods on the Reservoir Islands.** *An increase in mosquito production would occur under partial-storage, shallow-storage, or shallow water-wetland conditions. This effect is significant.*

Implementation of Alternatives 1 and 2 would result in an increase in mosquito production on the Habitat Islands and, during some years, on the Reservoir Islands, under partial-storage, shallow-storage, or shallow water-wetland conditions. Because conversion of the Reservoir Islands to water storage would result in an increase in mosquito breeding grounds, an increased need for abatement activities would occur. Therefore, this effect is **significant**.

Mitigation Measure HZ-MM-2: Develop an Integrated Pest Management Program and Coordinate Project Activities with SJCMVCD and CCCMVCD.

The project applicant shall consult and coordinate with DFW, the Habitat Management Advisory Council (HMAC), SJCMVCD, and CCCMVCD during all phases of the project, including design, implementation, and operations. The project's CMP shall be updated in accordance with the Best Management Practices (BMPs) identified in the Central Valley Joint Venture's *Technical Guide to Best Management Practices for Mosquito Control in Managed Wetlands* (Kwasny et al. 2004) and other guidelines such as the *Best Management Practices for Mosquito Control on California State Properties* (California Department of Public Health 2008); and *Best Management Practices for Mosquito Control in California* (California Department of Public Health and Mosquito and Vector Control Association of California 2010). The project applicant shall be responsible for coordination with SJCMVCD and CCCMVCD regarding mosquito control measures for the Reservoir Islands; and the project applicant, DFW, and HMAC shall be responsible for coordination regarding the Habitat Islands.

Consultation and coordination with SJCMVCD and CCCMVCD shall include the development of an IpM plan for mosquitoes that follows the guidelines of the *Best Management Practices for Mosquito Control in Managed Wetlands* (Kwasny et al. 2004) and the other guidelines listed above, and shall contain a continual maintenance program. An example list of the types of BMPs that may be included in the project's IpM plan is provided below.

Wetland Design Features

- Design water delivery and drainage systems to allow for rapid manipulation of water levels within the wetlands. This could include construction of swales sloped from inlet to outlet to allow the majority of the wetland to be drawn down quickly, and independent inlets and outlets for each wetland unit.
- Ensure that shorelines, which may be vacillating, do not isolate from the main body of water sections that create pockets where mosquitoes would be free of competition and predation.
- Create basins with a high slope index, variable depths, and shallow and deep regions that provide open water zones adjacent to shallow vegetated zones.
- Install cross-levees to facilitate more rapid flood-up.
- Excavate deep channels or basins to maintain permanent water areas (deeper than 2.5 feet) within a portion of seasonal wetlands to provide year-round habitat for mosquito predators that can inoculate seasonal wetlands when flooded.

Water Management Practices

- Delay flooding of some wetland units until later in the fall, and delay flooding units with greatest historical mosquito production and/or those closest to urban areas.
- Flood wetland units as quickly as possible.
- Ensure constant flow of water into wetlands to reduce water fluctuation from evaporation, transpiration, outflow, and seepage.
- Flood wetland as deep as possible at initial flood-up.
- Flood wetlands with water sources containing mosquitofish or other invertebrate predators. Water from permanent ponds can be used to passively introduce mosquito predators.
- Drain any irrigation water into locations with mosquito predators as opposed to adjacent seasonal wetland or dry fields.
- Avoid "pulses" of increased organic load to inhibit episodic fluctuation in mosquito population numbers during the months of April–October.
- Use flood and drain techniques as a method to eliminate larvae.

Vegetation Management Practices

- Avoid continuous stands of emergent vegetation. These stands generate microhabitats that support mosquito productivity by providing refuge from predation, accumulation and concentration of organic foods, and interference with water circulation and wave action.

- Maintain aquatic vegetation in islands surrounded by deeper water. This breaks up the uniform microhabitat and provides variable physical and biological constraints on the mosquito population.

- Avoid plants that tend to mat the water surface. Promote plants in islands such as bulrush and cattails, which function as substrate for mosquito predators. Plants such as sago pondweed for example, are completely submergent and contribute little to mosquito refuge while providing good predator refuge and even waterfowl food.

Wetlands Maintenance

- Maintain levees, water control structures, and ditches regularly.

- Manage vegetation through periodic harvesting, thinning, disking, or burning to maintain open areas.

- Remove silt and detritus periodically to maintain regular wetland depth.

Biological Controls

- Encourage on-site predator populations by providing permanent water sources for mosquitofish. Such "dry season" predator reservoirs should be 18 inches or more in depth to reduce predation of mosquitofish by herons and egrets.

- Avoid use of broad spectrum insecticides that not only kill mosquitoes, but also eliminate their natural predators.

- Ensure that mosquitofish have access to each basin.

Consultation with CCCMVCD and SJCMVCD

- Consult with CCCMVCD and SJCMVCD during the project design phase to incorporate design and operational elements of the Reservoir and Habitat Islands to reduce the mosquito production potential of the project.

- Consult with CCCMVCD and SJCMVCD on the timing of wetland flooding.

- Regularly consult with SJCMVCD and CCCMVCD to identify mosquito management problems, mosquito monitoring and abatement procedures, and opportunities to adjust operations to reduce mosquito production during problem periods.

- Develop an access plan with CCCMVCD and SJCMVCD to allow for monitoring and control of mosquito populations on the project islands.

- Work with CCCMVCD and SJCMVCD to understand pesticides used for mosquito abatement, and their costs and environmental effects.

- If it is necessary for SJCMVCD and CCCMVCD to increase mosquito monitoring and control programs beyond pre-project levels, the project applicant shall share costs with CCCMVCD and SJCMVCD or otherwise participate in implementing mosquito abatement programs.

Implementing Mitigation Measure HZ-MM-2 would reduce the adverse effect from increased mosquito breeding habitat to a **less-than-significant** level because wetland habitat would be constructed and maintained in accordance with SJCMVCD and CCCMVCD guidelines.

EFFECT HZ-6 **Increase in Potential Exposure of People to Wildlife Species that Transmit Diseases.** *The potential for transmission of wildlife-transmitted diseases such as Lyme disease, bubonic plague, and rabies to humans would not change following project implementation. No effect would occur.*

According to area mosquito vector control districts, non-mosquito disease vectors are not considered a substantial public health risk in the Delta (Sanabria and Lucchesi pers. comm.). Wildlife species that could transmit diseases to humans are not expected to be present on the Reservoir Islands because their habitats would be reduced substantially as a result of proposed water storage. Under Alternatives 1 and 2, the populations of wildlife species known to serve as hosts of wildlife-transmitted diseases affecting humans could increase on the Habitat Islands. However, because new recreational facilities would not be constructed, there would be no increase in potential human exposure to these wildlife-transmitted diseases. Therefore, **no effect** would occur.

Mitigation Measure: No mitigation is required.

Alternative 3

EFFECT HZ-1 **Potential Contamination of Stored Water by Contaminant Residues.** *Water storage on the Reservoir Islands could mobilize soil contaminants from historical pollution sites. If the contaminant concentrations are high, mobilization of the dissolved fraction of the contaminants could cause an adverse effect on Delta channel water quality from discharged water. This effect is significant.*

As discussed in the 2001 FEIS, the results of laboratory analyses from soil sampling (Appendix C6 to the 2001 FEIS, incorporated herein by reference) indicated that in general, project island soils do not contain substantial concentrations of agricultural chemicals. Exhibit 3.10-1 shows the location of potential contamination sites on Bacon Island and Holland Tract. The identified sites consisted of farm machinery repair facilities, pesticide storage areas, domestic waste dumps, and a copper salvaging site on Bacon Island; and historical pulp disposal areas on Holland Tract. No potential contamination sites were identified on Webb Tract or Bouldin Island. Water storage on Bacon Island could mobilize soil contaminants from historical pollution sites. If the contaminant concentrations are high, mobilization of the dissolved fraction of the contaminants could cause an adverse effect on Delta channel water quality from discharged water. This effect is **significant**.

Mitigation Measure: Implement Mitigation Measure HZ-MM-1 (Conduct Assessments of Potential Contamination Sites and Remediate as Necessary).

Implementing Mitigation Measure HZ-MM-1 would reduce this effect to a **less-than-significant** level because potential contamination sites would be assessed and remediated as necessary.

EFFECT HZ-2 **Reduction in Agricultural Pollutants.** *Fertilizers and pesticides currently used on agricultural land could contaminate agricultural drainwater that returns to Delta channels. Implementation of the project would have the beneficial effect of reducing these contaminants. This effect is less than significant.*

Implementation of Alternative 3 would result in more than a 16,000-acre reduction in harvested agricultural acres (see Table 3.2-2 in Section 3.2, “Agricultural Resources”). Fertilizers and pesticides currently used on this land can contaminate agricultural drainwater that returns to Delta channels. Since the land would be taken out of agricultural production, project implementation would have the beneficial effect of reducing these contaminants. Because implementation of Alternative 3 would result in over 2,000 additional acres being taken out of production as compared to Alternatives 1 and 2, a greater benefit would occur under Alternative 3 in terms of the reduction of agricultural pollutants. This effect is **less than significant**.

Mitigation Measure: No mitigation is required.

EFFECT HZ-3 **Aircraft Safety Hazards.** *Project implementation would not substantially change operation of the airstrip or existing aircraft safety hazards. This effect is less than significant.*

Under Alternative 3, the Bouldin Island airstrip would still be available for habitat maintenance (e.g., seed dispersal, application of herbicide and pesticide). The number of flights generated from the airstrip under Alternative 3 would be less than current levels for agricultural activities. Implementing the project would not substantially change operation of the airstrip, and would not substantially change existing aircraft safety hazards. Therefore, this effect is **less than significant**.

Mitigation Measure: No mitigation is required.

EFFECT HZ-4 **Reduction or Elimination of Mosquito Abatement Activities During Full-Storage Periods on the Reservoir Islands.** *During full-storage periods, mosquito production on the Reservoir Islands would be minimal. Deep, open-water habitats are poor mosquito breeding areas because the wave action generated over large water bodies disrupts the ability of larvae to penetrate the water surface and because vegetation necessary for egg laying and cover for larvae is lacking. This effect is beneficial and less than significant.*

Under Alternative 3, all four project islands would serve as Reservoir Islands. Deep, open-water habitats are poor mosquito breeding areas because the wave action generated over large water bodies disrupts the ability of larvae to penetrate the water surface and because vegetation necessary for egg laying and cover for larvae is lacking. Implementation of Alternative 3 would substantially reduce mosquito production as compared to existing conditions because all four islands would be used for water storage and, subsequently, the need for abatement on the Reservoir Islands during full-storage periods. Therefore, this effect is **beneficial and less than significant**.

Mitigation Measure: No mitigation is required.

EFFECT HZ-5 **Increase in Abatement Levels on the Habitat Islands and During Partial-Storage, Shallow-Storage, or Shallow Water-Wetland Periods on the Reservoir Islands.** *An increase in mosquito production would occur under partial-storage, shallow-storage, or shallow water-wetland conditions. This effect is significant.*

Implementation of Alternative 3 would result in an increase in mosquito production on the Habitat Islands that is greater than would be experienced under Alternatives 1 and 2 (because the Habitat Islands would be used for water storage under this alternative). During some years, an increase in mosquito production would occur on the Reservoir Islands as well, under partial-storage, shallow-storage, or shallow water-wetland conditions. Because conversion of the Reservoir and Habitat Islands to water storage would result in an increase in mosquito breeding grounds, an increased need for abatement activities would occur. Therefore, this effect is **significant**.

Mitigation Measure: Implement Mitigation Measure HZ-MM-2 (Develop an Integrated Pest Management Program and Coordinate Project Activities with SJCMVCD and CCCMVCD).

Implementing Mitigation Measure HZ-MM-2 would reduce this adverse effect to a **less-than-significant** level because wetland habitat would be constructed and maintained in accordance with SJCMVCD and CCCMVCD guidelines.

EFFECT HZ-6 **Increase in Potential Exposure of People to Wildlife Species that Transmit Diseases.** *Wildlife species that could transmit diseases to humans are not expected to be present on the project islands under Alternative 3 because their habitats would be reduced substantially as a result of increased water storage on all four islands. No effect would occur.*

Wildlife species that could transmit diseases to humans are not expected to be present on the Reservoir Islands because their habitats would be reduced substantially as a result of proposed water storage. Under Alternative 3, the Habitat Islands would be used for water storage, with the exception of the North Bouldin Habitat Area. The populations of wildlife species known to serve as hosts of wildlife-transmitted diseases affecting humans could increase in that area, but that increase would be negligible relative to the reduction in populations resulting from water storage. Therefore, implementing Alternative 3 would not affect the incidence of wildlife-transmitted diseases affecting humans. **No effect** would occur.

Mitigation Measure: No mitigation is required.

Table 3.10-1
Comparison of Delta Wetlands Project 2001 FEIS and this SEIS Effects and Mitigation Measures for Hazardous Waste and Materials

2001 FEIS Effects and Mitigation Measures	SEIS Effects and Mitigation Measures
Alternatives 1 and 2 (Proposed Action)	
Impact C-8: Potential Contamination of Stored Water by Pollutant Residues (LTS-M) **Mitigation Measure C-8:** Conduct Assessments of Potential Contamination Sites and Remediate as Necessary	**Effect HZ-1:** Potential Contamination of Stored Water by Contaminant Residues (LTS-M) **Mitigation Measure HZ-MM-1:** Conduct Assessments of Potential Contamination Sites and Remediate as Necessary No change.
Not previously analyzed.	**Effect HZ-2:** Reduction in Agricultural Pollutants (B and LTS) **Mitigation:** No mitigation is required.
Discussed in text but not numbered.	**Effect HZ-3:** Aircraft Safety Hazards (LTS) **Mitigation:** No mitigation is required. No change.
Impact N-1: Reduction or Elimination of Mosquito Abatement Activities during Full-Storage Periods on the Reservoir Islands (B) **Mitigation:** No mitigation is required.	**Effect HZ-4:** Reduction or Elimination of Mosquito Abatement Activities during Full-Storage Periods on the Reservoir Islands (B and LTS) **Mitigation:** No mitigation is required. No change.
Impact N-2: Increase in Abatement Levels on the Habitat Islands and during Partial-Storage, Shallow-Storage, or Shallow-Water Wetland Periods on the Reservoir islands (LTS-M) **Mitigation Measure N-1:** Coordinate Project Activities with SJCMAD and CCMAD.	**Effect HZ-5:** Increase in Abatement Levels on the Habitat Islands and during Partial-Storage, Shallow-Storage, or Shallow Water-Wetland Periods on the Reservoir Islands (LTS-M) **Mitigation Measure HZ-MM-2:** Develop an Integrated Pest Management Program and Coordinate Project Activities with SJCMVCD and CCCMVCD. This effect has not changed. The mitigation measure has been updated to conform to current guidelines regarding design and management of constructed wetlands.
Impact N-3: Increase in Potential Exposure of People to Wildlife Species that Transmit Diseases (LTS) **Mitigation:** No mitigation is required.	**Effect HZ-6:** Increase in Potential Exposure of People to Wildlife Species that Transmit Diseases (NI) **Mitigation:** No mitigation is required. Because no new recreation facilities would be constructed, there would no change from existing conditions.
Alternative 3	
Impact C-8: Potential Contamination of Stored Water by Pollutant Residues (LTS-M) **Mitigation Measure C-8:** Conduct Assessments of Potential Contamination Sites and Remediate as Necessary	**Effect HZ-1:** Potential Contamination of Stored Water by Contaminant Residues (LTS-M) **Mitigation Measure HZ-MM-1:** Conduct Assessments of Potential Contamination Sites and Remediate as Necessary No change.
Not previously analyzed.	**Effect HZ-2:** Reduction in Agricultural Pollutants (B and LTS). **Mitigation:** No mitigation is required.

Table 3.10-1 Comparison of Delta Wetlands Project 2001 FEIS and this SEIS Effects and Mitigation Measures for Hazardous Waste and Materials	
2001 FEIS Effects and Mitigation Measures	SEIS Effects and Mitigation Measures
Discussed in text but not numbered.	**Effect HZ-3:** Aircraft Safety Hazards (LTS) **Mitigation:** No mitigation is required. No change.
Impact N-4: Reduction or Elimination of Mosquito Abatement Activities during Full-Storage Periods on the Reservoir Islands (B) **Mitigation:** No mitigation is required.	**Effect HZ-4:** Reduction or Elimination of Mosquito Abatement Activities during Full-Storage Periods on the Reservoir Islands (B and LTS) **Mitigation:** No mitigation is required. No change.
Impact N-5: Increase in Abatement Levels during Partial-Storage, Shallow-Storage, or Shallow-Water Wetland Periods on the Reservoir Islands and in the NBHA (LTS-M) **Mitigation Measure N-1:** Coordinate Project Activities with SJCMAD and CCMAD.	**Effect HZ-5:** Increase in Abatement Levels during Partial-Storage, Shallow-Storage, or Shallow Water-Wetland Periods on the Reservoir Islands and in the NBHA (LTS-M) **Mitigation Measure HZ-MM-2:** Develop an Integrated Pest Management Program and Coordinate Project Activities with SJCMVCD and CCCMVCD. This effect has not changed. The mitigation measure has been updated to conform to current guidelines regarding design and management of constructed wetlands.
Discussed in text, impact not numbered.	**Effect HZ-6:** Increase in Potential Exposure of People to Wildlife Species that Transmit Diseases (NI) **Mitigation:** No mitigation is required. No change.
Notes: Shading denotes changes in the effect, significance conclusion, or mitigation measure from the 2001 FEIS; LTS = Less than significant; LTS-M = Less than significant with mitigation; B = Beneficial; NI = No impact Sources: ICF 2010: 4.2-3 through 4.2-5 and 4.12-2and AECOM 2014	

3.10.6 Secondary and Cumulative Effects

Secondary and cumulative hazardous waste and materials effects and effects related to public health resulting from implementing the project were described in the 2001 FEIS (Chapters 3C and 3M) and the 2010 DEIR (Chapter 5). The 2001 FEIS and 2010 DEIR are herein incorporated by reference, and the effect conclusions and mitigation measures, along with any changes, are summarized briefly below and shown in Table 3.10-2.

Potential Water Contamination from Known Hazardous Wastes

Two of the four project islands, Bacon Island and Holland Tract, contain areas of known hazardous wastes. Water stored on the project islands could become contaminated with this waste, and in turn transport those pollutants into Delta waters. Some of the projects considered in this cumulative analysis may also result in increased local or regional water contamination as a result of mobilization of constituents in known areas of hazardous wastes. Therefore, the project's contribution would be cumulatively considerable.

> Mitigation Measure: Implement Mitigation Measure HZ-MM-1 (Conduct Assessments of Potential Contamination Sites and Remediate as Necessary).

Implementing Mitigation Measure HZ-MM-1would reduce the project's contribution to a level that is not cumulatively considerable because contamination sites would be assessed and remediated as necessary.

Potential Water Contamination from Agricultural Chemicals

Project implementation would remove between 14,000 and 16,000 acres of land from agricultural use and into water storage. Although some of the projects considered in this cumulative analysis may increase the amount of water that could be contaminated by agricultural chemicals, the project would substantially reduce the potential for agricultural water contamination. Therefore, the project's contribution would not be cumulatively considerable and would be beneficial.

Increase in Abatement Levels During Partial-Storage, Shallow-Storage, or Shallow-Water Wetland Periods on the Reservoir Islands under Cumulative Conditions

If SWP export pumping is increased to full capacity in future years, the availability of mosquito breeding habitat would generally be reduced from May through August and increased during September and October. The project's contribution to this cumulatively significant effect is cumulatively considerable.

Mitigation Measure: Implement Mitigation Measure HZ-MM-2 (Develop an Integrated Pest Management Program and Coordinate Project Activities with SJCMVCD and CCCMVCD).

Implementing Mitigation Measure HZ-MM-2 would reduce the project's contribution to this cumulative effect to a level that is not cumulatively considerable because wetlands would be designed and maintained according to SJCMVCD and CCCMVCD guidelines.

Cumulative Increase in Mosquito Abatement Needs

The project would affect mosquito breeding habitat by reducing it from May through August and increasing it during September and October. Other projects, including the North Delta Flood Control and Ecosystem Restoration project, Liberty Island Restoration, the CVP-SWP OCAP, and the CALFED ERP, also have the potential to create increased mosquito breeding habitat. Development around the periphery of the Delta increases the risk to people of mosquito-borne diseases. These combined increases require mosquito abatement districts such as SJCMVCD and CCMVCD to increase control efforts, thereby increasing overall costs for abatement. Mitigation should be implemented for each project during the project evaluation and approval process to minimize the cumulative effects on mosquito abatement; however, there is no guarantee that such mitigation would occur. The project's contribution to this cumulatively significant effect is cumulatively considerable.

Mitigation Measure: Implement Mitigation Measure HZ-MM-2 (Develop an Integrated Pest Management Program and Coordinate Project Activities with SJCMVCD and CCCMVCD).

Implementation of Mitigation Measure HZ-MM-2 would reduce the project's contribution to cumulative increases in mosquito abatement needs. However, because there is no guarantee that mitigation measures would be implemented for other future projects, this cumulative effect is cumulatively significant and unavoidable.

Table 3.10-2
Comparison of Secondary and Cumulative Hazardous Waste and Materials Effects between the 2001 FEIS and this SEIS

2001 FEIS Cumulative Effects and Mitigation Measures	SEIS Cumulative Effects and Mitigation Measures
Not previously analyzed.	Potential Water Contamination from Known Hazardous Wastes (NCC-M) **Mitigation Measure HZ-MM-1:** Conduct Assessments of Potential Contamination Sites and Remediate as Necessary
Not previously analyzed.	Potential Water Contamination from Agricultural Chemicals (NCC and B) **Mitigation:** No mitigation is required.
Impact N-6: Increase in Abatement Levels during Partial-Storage, Shallow-Storage, or Shallow-Water Wetland Periods on the Reservoir Islands under Cumulative	Increase in Abatement Levels during Partial-Storage, Shallow-Storage, or Shallow-Water Wetland Periods on the Reservoir Islands under Cumulative Conditions (NCC-M)

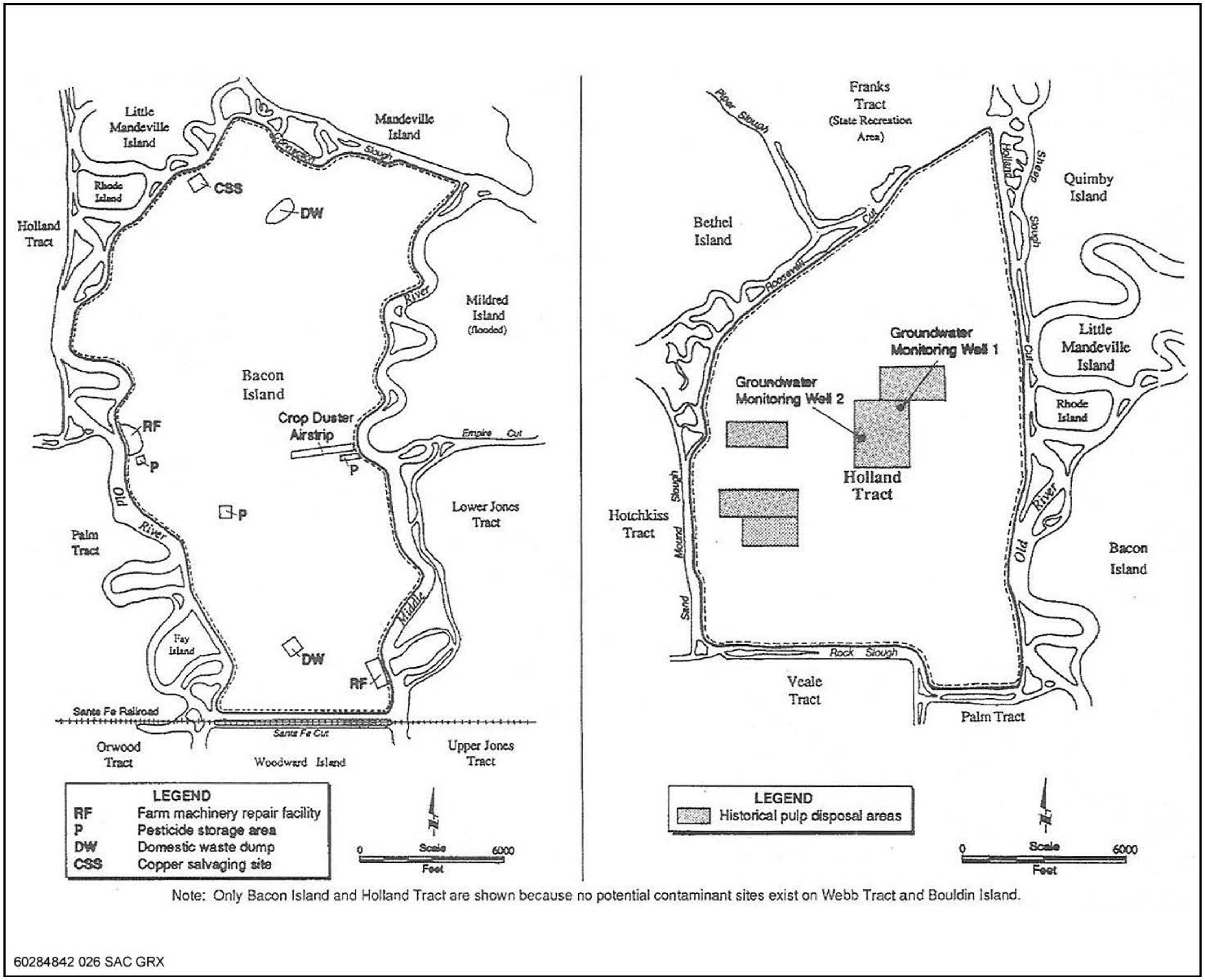
Table 3.10-2
Comparison of Secondary and Cumulative Hazardous Waste and Materials Effects between the 2001 FEIS and this SEIS

2001 FEIS Cumulative Effects and Mitigation Measures	SEIS Cumulative Effects and Mitigation Measures
Conditions (NCC-M) **Mitigation Measure N-1:** Coordinate project Activities with SJCMAD and CCMAD	**Mitigation Measure HZ-MM-2:** Develop an Integrated Pest Management Program and Coordinate Project Activities with SJCMVCD and CCCMVCD. No change to effect, mitigation measure has been updated.
Impact N-7: Cumulative Increase in Mosquito Abatement Needs Resulting from Implementation of Future projects, Including the DW project (CCU) **Mitigation:** No mitigation is available.	Cumulative Increase in Mosquito Abatement Needs Resulting from Implementation of Future projects, Including the Project (CCU) **Mitigation Measure HZ-MM-2:** Develop an Integrated Pest Management Program and Coordinate Project Activities with SJCMVCD and CCCMVCD. Effect discussion has been updated, mitigation measure has been added.

Notes: Shading denotes changes in the effect, significance conclusion, or mitigation measure from the 2001 FEIS; CCU = Cumulatively considerable and unavoidable; NCC-M = Not cumulatively considerable with mitigation; B = Beneficial

Sources: ICF 2010:5-31, 5-35 through 5-36 and AECOM 2013

Source: ICF 2000, Adapted by AECOM in 2013



Note: Only Bacon Island and Holland Tract are shown because no potential contaminant sites exist on Webb Tract and Bouldin Island.

Exhibit 3.10-1 **Areas of Known Hazardous Waste on the Project Islands**

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3.11 HYDROLOGY AND WATER QUALITY

3.11.1 INTRODUCTION

Project implementation could affect the movement of water in Sacramento-San Joaquin (Delta) Delta channels (e.g., changes in channel flows and stages, export flows, and outflow). Potential changes in net Delta channel flows and local channel flows and stages resulting from project implementation were evaluated in the 2001 FEIS in Chapter 3B, "Hydrodynamics," and that section is incorporated herein by reference. In addition to hydrodynamic changes in certain Delta channels, Delta water quality could be modified from project-related diversions, storage, and discharges.

This section describes changes to the "Affected Environment" and "Regulatory Framework/Applicable Laws, Regulations, Plans, and Policies" since the 2001 FEIS was prepared and describes changed environmental effects related to hydrology and water quality for the project. A review and update of the 1995 DEIR/EIS water quality assessment was incorporated in the 2001 FEIS. Chapter 3C in the 2001 FEIS provided detailed information regarding water quality effects associated with the project and in the Delta in general. The water quality effects of the project were analyzed most recently in Section 4.2 and Chapter 5 of the 2010 DEIR, which also served as a basis for this analysis. The 1995 DEIR/EIS, 2001 FEIS, and 2010 DEIR are herein incorporated by reference. For ease of readability, all exhibits are presented at the end of this section.

Water quality in the Delta is important for the aquatic ecosystem, drinking water supply, and irrigation. This section contains a review and update of the 2001 FEIS water quality effects assessment. For water quality constituents with little or no change in information or circumstances, a summary of the results of the analysis from the 2001 FEIS is provided. A more detailed assessment is provided for water quality constituents with new information or regulations.

The hydrodynamics analysis for Alternative 2 (the Proposed Action) has been updated for this SEIS. The 2001 FEIS concluded that hydrodynamics effects for all three action alternatives would be less than significant, and that conclusion has not changed.

Identification of the project's specific places of use does not affect hydrodynamics or water quality in any way that alters the conclusions of the 2001 FEIS.

The 2001 FEIS concluded that diverting water onto the project islands would reduce Delta outflows and could increase salinity in Delta channels and at Delta export facilities and municipal and agricultural diversions. Discharges from the project islands could contribute to changes in concentrations of water quality constituents and other variables in Delta channel receiving waters and at Delta export facilities and diversions. Variables that could be adversely affected by project discharges consist of salinity, dissolved organic carbon (DOC), temperature, turbidity, dissolved oxygen (DO), and chlorophyll (algae). In drinking water supplies that originate from the Delta, increases in DOC and salinity could cause increased disinfection by-products following treatment. Also of concern are pollutants that may remain in some project island soils as a result of past agricultural and waste disposal activities; if pollutants are present, they could contaminate stored water that is later discharged into Delta channels.

The 2001 FEIS found that proposed diversions under Alternatives 1, 2, or 3 could result in salinity increases at Chipps Island, Emmaton, and Jersey Point and in Delta exports during periods of low Delta outflow such that significant effects could occur. The incorporation of the Final Operating Criteria (FOC) terms into the Proposed Action (Alternative 2) would reduce the estimated salinity effects at Chipps Island and in Delta exports, and therefore the effect would be less than significant. All other salinity effects would be reduced to less-than-significant levels through FOC adjustments made to project diversions based on salinity estimates at these locations with and without project diversions.

The 2001 FEIS analysis found that proposed discharges under Alternatives 1, 2, or 3 could result in increases of DOC concentrations in Delta exports and could cause increased trihalomethane (THM) concentrations in drinking water treated by chlorination such that significant effects could occur. These potential effects would be reduced to less-than-significant levels through adjustments of project discharges based on real-time measurements of DOC and estimated bromide (Br-) in stored water during intended discharge periods and monitoring of channel receiving waters.

The 2001 FEIS analysis found that proposed discharges under Alternatives 1, 2, or 3 could result in changes in water quality variables with potential effects on fish (i.e., temperature, turbidity, DO, and chlorophyll) in Delta channel receiving waters such that significant effects could occur. This effect would be reduced to a less-than-significant level through adjustments of project discharges based on real-time measurements of these variables in stored water during intended discharge periods and monitoring in channel receiving waters. Potential contamination of stored water by pollutant residues from existing sources of hazardous materials is evaluated in Section 3.10, "Hazardous Waste and Materials."

SUMMARY OF CHANGES, NEW CIRCUMSTANCES, AND NEW INFORMATION

Substantial Changes in the Project

There have been no substantial changes in the project resulting in new significant adverse effects or a substantial increase in the severity of effects on water quality. The identification of specific places of use for stored water does not change the water quality effects.

The project now incorporates the water quality management plan (WQMP) (described in detail below under "Environmental Commitments" and in Chapter 2, "Project Description and Alternatives") that was prepared as part of the water right protest dismissal agreements as an environmental commitment. Because the 2000 RDEIR/EIS water quality evaluation (i.e., modeling, herein incorporated by reference) did not include the specific WQMP provisions, water quality effects of the project are expected to be less than those described for the 2001 FEIS.

The project no longer includes a proposal to construct new recreation facilities on the Reservoir or Habitat Islands; this change to the project results in a reduction and/or elimination of some the previously identified environmental effects.

New Circumstances

Three water quality constituents were selected for reassessment or first-time assessment for this SEIS based on new regulations or WQMP restrictions placed on the project:

- The analysis of dissolved oxygen content (DOC) was updated because there have been new studies that may provide substantial new information, and the WQMP limits the potential effects on DOC at the export facilities and drinking water diversions.
- The mercury analysis was updated because of the new draft total maximum daily limit (TMDL) regulations for mercury in the Delta (Wood et al. 2010a).
- The salinity (i.e., chloride, bromide, and electrical conductivity [EC]) analysis was updated because the WQMP places more restrictive conditions for diverting water onto the Reservoir Islands, and the salinity of the stored water therefore is expected to be lower. Several potential benefits associated with this low salinity water are considered in this analysis, including project releases for increased Delta outflow that would lower salinity in the Delta during some fall months.

Because some of the project's operational criteria have changed (as discussed in Chapter 2, "Project Description and Alternatives") since the 2001 FEIS was prepared, the hydrodynamics modeling for the Proposed Action was updated by Resource Management Associates (RMA) in 2013. A copy of the technical memorandum prepared by RMA is attached as Appendix I.

The updated modeling consists of three components:

- velocity at various near-field and midfield locations in the Delta;
- stages at three south Delta agricultural barrier locations implemented in planning model studies (in Middle River, in Old River, and in Grant Line Canal), and at three additional locations in the Old and Middle River corridor; and
- monthly average net flow at three locations identified in previous modeling work prepared for the 1995 DEIR/DEIS and the 2001 FEIS as potentially influenced by project operations: (1) in Old River near Bacon Island (ROLD024), (2) in Threemile Slough near the confluence with the San Joaquin River (SLTRM004), and (3) in the lower San Joaquin River (RSAN007) near Antioch.

New Information

The key sources of new data and information used to assess changes in the "Affected Environment" and effects analysis following the publication of the 2001 FEIS that relate to hydrodynamics and water quality are listed below.

- *In-Delta Storage Program Draft Feasibility Study Report on Environmental Evaluations* (California Department of Water Resources 2003a).
- *2006 Supplemental Report to the 2004 Draft Feasibility Study In-Delta Storage Project* (California Department of Water Resources 2006). This includes a supporting document by Dr. K. R. Reddy, *Review of Delta Wetlands Water Quality: Release and Generation of Dissolved Organic Carbon from Flooded Peatlands—Final Report 2005* (Reddy 2005).
- *Delta Wetlands Project Water Quality Management Plan* (Appendix C to this SDEIS).
- *Jones Tract Flood Water Quality Investigations* (California Department of Water Resources 2009).
- *Numerical Modeling for the Delta Wetlands Project*, Technical Memorandum (Resource Management Associates 2013, Appendix I to this SDEIS).

SUMMARY OF ENVIRONMENTAL COMMITMENTS

Environmental commitments are measures incorporated by the project applicant as part of the project, meaning they are proposed as elements of the Proposed Action and are therefore considered in conducting the environmental analysis for each resource area of this SEIS. The purpose of environmental commitments is to reflect and incorporate best practices into the project that avoid, minimize, reduce, or offset potential environmental effects. A description of the environmental commitments that have been incorporated into the project since the 2001 FEIS is contained in Chapter 2, "Project Description and Alternatives," of this SEIS. The environmental commitments relevant to hydrology and water quality are discussed below.

Water Quality Management Plan

The WQMP was developed as part of the protest dismissal agreement between the project and the California Urban Water Agencies (CUWA) during the project's water right hearing in 2000 and amended in 2013 to include taste and odor concerns from the urban water utilities that are diverting water from the Delta. This environmental commitment manages the reservoir storage and discharges to minimize the drinking water quality effects. The WQMP also was included as a condition of the protest dismissal agreement with Contra Costa Water District (CCWD). The CCWD agreement includes operational restrictions to reduce the effects of the project on CCWD's diversions and Los Vaqueros Reservoir salinity management and fish protection operations. A copy of the 2013 WQMP is presented in Appendix C.

A key principle of the WQMP is that "project operations shall minimize and mitigate for any degradation in the quality of drinking water supplies." The major provisions of the WQMP address salinity and DOC concentrations at Delta export facilities. The WQMP requires the establishment of a water quality management board to review, approve, and implement the annual water quality operating plan. The operating plan would establish maximum Reservoir Island concentrations for salinity (total dissolved solids [TDS]), chloride, bromide, and total organic carbon (TOC). Measures to control effects on exports and diversions would be established and implemented when project storage concentrations approach these maximum allowable concentrations. These measures generally involve adjusting discharges for export or releasing storage water during periods of high outflow to minimize potential effects on exports and municipal water quality.

A monitoring program would be established to support and implement the WQMP for the project. Available California Data Exchange Center (CDEC) data would be incorporated into the water quality monitoring and reporting program to implement the water quality control measures. Hydrodynamic and water-tracking modeling would be used to estimate the effects of project discharges on water quality at CVP, SWP, CCWD, and other urban intakes. The WQMP covers short-term effects as well as a long-term accounting of the effects of project operations on exports and municipal water quality.

Short-term effects would be minimized using operational criteria. A short-term effect is defined by the WQMP as any adverse health effects, contribution to any non-compliance with drinking water regulations, and any increase in treatment or operation cost caused by increased concentrations of TOC or salinity. Project operations criteria would be established for TOC, bromide, and chloride, based on existing disinfection by-product regulations (DBP). These criteria would limit project discharges, unless the treatment plant operators agree that the additional water supply or other benefit of the project would compensate for the increased treatment expenses.

Project operations may not cause the TOC concentration at an export facility or diversion to increase more than 1 milligram per liter (mg/l), or cause the TOC concentration to exceed 4 mg/l. The reason being that if the TOC concentration were greater than 4 mg/l, a treatment plant may be required to provide more TOC removal (35% rather than 25%) prior to disinfection to minimize formation of DBP, which might increase the treatment costs, although DBP concentrations might be reduced accordingly.

Project operations also may not cause an increase in chloride of more than 10 mg/l, nor should any increase result in chloride exceeding 90% of the established chloride objective (e.g., 250 mg/l at Rock Slough). These operations criteria would limit project discharges to less than 20% of the exports if the project storage chloride concentration was more than 50 mg/l higher than the baseline chloride concentration. Because the project operations simulated for this SEIS would divert water to storage only when outflow was greater than 11,400 cfs (i.e., X2 downstream of Chipps Island), the electrical conductivity (EC) at Jersey Point likely would be less than 200 microSiemens per centimeter (µS/cm), and the chloride likely would be less than 50 mg/l. Bromide can be estimated as 0.0035 times the chloride, so the bromide concentration would be 175 µg/l. The difference between the project chloride and the baseline export chloride would not be more than 50 mg/l. These operations criteria would limit project discharges to less than 20% of the exports if the project storage chloride concentration was more than 50 mg/l higher than the baseline chloride concentration.

In addition, the WQMP includes operations criteria for estimated effects at treatment plants. Project operations may not cause the modeled THM or bromate concentrations (e.g., using regression equations for TOC and bromide) at any treatment plant using Delta water to be greater than 80% of the established maximum contaminant level. The reason being that higher TOC or bromide concentrations might require higher treatment levels with associated cost.

The 2013 WQMP includes provisions to minimize taste and odor impacts at water treatment plants that are caused or contributed to by discharges from the Reservoir Islands. The 2013 WQMP contains measures to ensure that project operations would not cause an increase in total nitrogen or total phosphorus, cause 2-methylisoborneol (MIB) and geosmin concentrations to exceed 8 nanograms per liter (ng/L), or cause algal toxins to reach problematic levels at one or more of the urban intakes. Also, as a general operating principle, the 2013 WQMP requires the project to manage algal growth on the Reservoir Islands to minimize the production of algal toxins, taste- and odor-producing algae, filter-clogging algae, and/or toxin-producing algae. A copy of the 2013 WQMP is provided in Appendix C.

Final Operations Criteria and Biological Opinions

The Delta Wetlands Final Operations Criteria (FOC) were developed in 1997 during consultation with the U.S. Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS), and California Department of Fish and Wildlife (DFW) for the project's biological opinions (BOs). The FOC was considered in the 2001 FEIS assessment of water quality, and a copy of the FOC is included in the Delta Wetlands—CUWA agreement in the "Appendix to the Responses to Comments" in 2001 FEIS Volume 2, incorporated herein by reference. As a result of the FOC, which is now part of the project, some significant water quality effects have become less than significant. The FOC addresses a number of water quality concerns discussed below and in Section 3.4, "Aquatic Resources." Copies of the BOs were included in Appendices A through E in the 2000 RDEIR/EIS and in Volume 2 of the 2001 FEIS, "Appendix to the Responses to Comments," which are incorporated by reference herein and are included with this SEIS on CDs.

X2—Movement of water onto and off of the Delta islands potentially could affect the salinity of the Delta and the position of X2. The 1997 X2 criteria restrict diversions to storage to times when the position of X2 is at or downstream of particular locations. These restrictions are present in the 1997 Operations Criteria (2000 RDEIR/EIS, Appendix B, incorporated herein by reference) because it is believed that keeping the Delta more fresh as indicated by an X2 location closer to the ocean, would help special-status fish species. Under the Delta Wetlands project, the criteria for X2 would be modified to be more restrictive than what is stated in the 1997 Operations Criteria. The project would restrict diversions to storage to times when X2 is located at or downstream of Chipps Island. This restriction would have two benefits: (1) it would ensure that the water diverted to storage is of low salinity, and (2) it would ensure that diversions to storage are unlikely to have deleterious fish effects associated with potential upstream movement of the X2 location.

Water Temperature—In order to protect fish, the 1997 Operations Criteria make the following temperature restrictions on the release of water from storage:

- The project shall not discharge reservoir water for export if the temperature differential between the discharge and the adjacent channel temperature is greater than or equal to 20°F.
- If the natural receiving water temperature of the adjacent channel is greater than or equal to 55°F and less than 66°F, project discharges for export shall not increase the channel temperature/by more than 4°F.
- If the natural receiving water temperature of the adjacent channel is greater than or equal to 66°F and less than 77°F, project discharges for export shall not cause an increase of more than 2°F.
- If the natural receiving water temperature of the adjacent channel is greater than or equal to 77°F, project discharges for export shall not cause an increase of more than 1°F.

Dissolved Oxygen—To protect fish, the 1997 Operations Criteria make the following DO restrictions on the release of water from storage:

- The project shall not discharge reservoir water for export if the discharge DO level is less than 6.0 mg/l without authorization from the resource agencies and notice to the responsible agencies.
- The project shall not discharge reservoir water for export if the discharge would cause channel water DO levels to fall below 5.0 mg/l.

The FOC may need to be modified to account for the simulated and more restrictive operations of the project. However the restrictions pertaining to X2, DO, and temperature are not likely to be modified substantially.

Stormwater Pollution Prevention Plan, Best Management Practices, and Dewatering Permits

Construction activities have the potential to introduce contaminants into nearby water bodies. The project applicant would implement best management practices (BMPs) to minimize water pollution associated with construction, as described below. (BMPs would be specified in permits required for construction activities.)

Erosion

In order to obtain coverage under the National Pollutant Discharge Elimination System (NPDES) General Construction Permit, a stormwater pollution prevention plan (SWPPP) is required. Site-specific erosion control measures would be developed as part of the SWPPP. BMPs that would be contained in the SWPPP consist of, but are not limited to, the following:

- **Timing of construction.** Conduct earthwork during dry months.
- **Staging of construction equipment and materials.** Stage construction equipment and materials on the landside of construction areas. To the extent possible, stage equipment and materials in areas that already have been disturbed.
- **Soil and vegetation disturbance.** Minimize ground and vegetation disturbance during construction by establishing designated equipment staging areas, ingress and egress corridors, spoils disposal and soil stockpile areas, and equipment exclusion zones prior to the commencement of construction.
- **Grading spoils.** Stockpile soil and grading spoils on the landside of the subject levee reaches, and install sediment barriers (e.g., silt fences, fiber rolls, straw bales) around the base of stockpiles to intercept runoff and sediment during storm events. If necessary, cover stockpiles with geotextile fabric to provide protection against wind and water erosion.
- **Sediment barriers.** Install sediment barriers on graded or otherwise-disturbed slopes as needed to prevent sediment from leaving the Project site and entering nearby surface waters.
- **Site stabilization.** Install native plant materials to stabilize cut and fill slopes and other disturbed areas once construction is complete. Plant materials may include an erosion control seed mixture or shrub and tree container stock. Temporary structural BMPs, such as sediment barriers, erosion control blankets, mulch, and a mulch tackifier, may be installed as needed to stabilize disturbed areas until vegetation becomes established.

Pollutants

Other BMPs may be established to minimize the potential for and effects from spills of harmful substances during construction and operation activities. These may include practices such as double-walled tanks, containment berms, emergency shut-offs, drip pans, fueling procedures, and spill response kits, as well as ensuring training in proper handling procedures and spill prevention and response procedures.

Dewatering

Before discharging any dewatered effluent to surface water, the project applicant or its contractors would obtain a Low Threat Discharge and Dewatering NPDES permit from the Central Valley Regional Water Quality Control Board (RWQCB). Depending on the volume and characteristics of the discharge, coverage under the Central Valley RWQCB's NPDES General Construction Permit or General Dewatering Permit is possible. As part of the permit, the permittee would design and implement measures as necessary so that the discharge limits identified in the relevant permit are met.

As a performance standard, these measures would be selected to achieve maximum sediment removal and represent the best available technology that is economically achievable. Implemented measures may include the retention of dewatering effluent until particulate matter has settled, use of infiltration areas, and other BMPs.

3.11.2 AFFECTED ENVIRONMENT

HYDRODYNAMICS

In addition, three new diversions are located in the Delta: CCWD has constructed the Middle River Intake and Pumping Station on Victoria Canal, the City of Stockton has constructed a new intake on the San Joaquin River at Empire Tract, and a new water supply intake was constructed in 2007 near the SWP Harvey O. Banks Pumping Plant (SWP Banks) to service the Mountain House community. A summary of the affected environment is provided below.

Hydrodynamics entails the study of the influences (such as tidal forces and inflows) on the movement of water in Delta channels, and the effects of that water movement in Delta channels (i.e., changes in channel flows and stages, export flows, and outflow). Delta hydrodynamics depend primarily on the physical arrangement of Delta channels, inflows, diversions and exports from the Delta, and tides. Delta hydrodynamics govern channel flows and Delta outflow dynamics related to tidal variations in stage, velocity, and flow. Delta outflow dynamics also contribute to salinity intrusion and estuarine habitat conditions.

Delta Channels

Delta channels are generally less than 30 feet deep unless dredged and vary in width from less than 100 feet to over 1 mile. Some channels are edged with aquatic and riparian vegetation, but most are bordered by steep banks of mud or riprapped levees. Vegetation is generally removed from channel margins to improve flow and facilitate levee maintenance. Delta hydrodynamic simulations depend on accurate geometry data for each of the Delta channels. Surface area is important in determining the upstream tidal flow for a given change in stage at a Delta channel location represented by a model node. Cross-sectional area is important for estimating channel flow velocity. Cross-sectional areas and lengths of channels (with corresponding friction factors) determine divisions of flow when tidal flows can move into more than one channel. Volume determines the change in stage corresponding to a tidal inflow or outflow at a channel location. Tidal flushing at a location can be estimated as the tidal flow divided by the volume.

Delta Inflows

Upstream storage and diversions have increased considerably in the San Joaquin River Basin during the last 30 years. Increased storage capacity has allowed greater diversions of runoff for seasonal storage and subsequent use. The San Joaquin River inflow to the Delta is regulated to satisfy maximum salinity standards (with minimum flows) and pulse-flow requirements, as specified in the 2006 WQCP.

Delta Exports and Diversions

Delta export pumping occurs at the CVP Tracy Pumping Plant and SWP Banks Pumping Plant in the south Delta, while smaller but still sizeable diversions occur at CCWD's Rock Slough, Old River, and Middle River intakes, and at DWR's North Bay Aqueduct pumps at Barker Slough. Numerous other smaller diversions primarily for local agricultural water supplies are found throughout the Delta.

Delta Tidal Effects

Tidal changes strongly influence Delta channel conditions twice daily by changing water surface elevation, current velocity, and flow direction. The effects of ocean tides on Delta hydrodynamic conditions are modified by freshwater inflow and diversion rates. The extent of tidal influence depends on the tidal prism volume relative to river discharge at a particular Delta location, as described below.

Tidal effects are more intense closer to Suisun Bay, but even in the central Delta, water surface elevation can vary by more than 5 feet during one tidal cycle. Tidally influenced channel velocities can range from -2 feet per second (fps) to more than +3 fps (with negative figures indicating upstream flood tide flow). High river flows can cause high stages and velocities in some channel segments. Diversions and export pumping can also increase channel velocities.

Tidal effects are not uniform from day to day. There is a distinct pattern of tidal variations within a lunar month. The tidal range is greatest during "spring" tides and smallest during "neap" tides. The mean tide elevation may also change slightly during the spring-neap lunar cycle. This adds a net "tidal outflow" component to daily Delta outflow estimates. However, the RMA hydrodynamic model simulated a constant average tide for every tidal day throughout each month.

Delta Outflow Effects

Salinity Intrusion

Seawater intrusion in Suisun Bay is directly related to Delta outflow patterns. Salinity intrusion in the central Delta is increased when in-Delta diversions and exports, in combination with low Delta inflow, cause net flow to reverse in the lower San Joaquin River near Antioch and Jersey Point. Some salt is transported into the central Delta by the tidal flow patterns. Salinity effects are discussed in greater detail below under the heading "Water Quality."

Estuarine Entrapment Zone

The estuarine "entrapment zone," or null zone, is an important aquatic habitat region associated with high levels of biological productivity. The entrapment zone is the zone of transition between gravitational circulation and river-like net seaward flow. Gravitational circulation is the flow pattern caused by salinity (density) gradients in which mean bottom flow is landward and mean surface flow is seaward. Gravitationally induced currents are usually small fractions of tidal currents and are weakened by enhanced vertical mixing associated with increased tidal flows. In general, gravitational currents are highest in the region of the steepest salinity gradient (i.e., greatest change in salinity with distance). High outflows move the salinity gradient seaward, decreasing the influence of gravitational circulation on the Delta.

The location of the entrapment zone is determined by the magnitude and duration of Delta outflow. The zone moves seaward rapidly in response to increased freshwater discharge. With decreased discharge, the zone gradually moves upstream. X2 is the location of the upstream boundary of the entrapment zone. The potential effects of project operations on estuarine habitat conditions are assessed in Section 3.4, "Aquatic Resources."

Hydrodynamics Near the Project Islands

Hydrodynamics in channels adjacent to the four project islands depend largely on overall Delta hydrodynamics. The channels bordering Bacon Island and Holland Tract function primarily as transport channels moving water toward the export pumps. Net flow in these channels generally moves upstream toward the CVP, SWP, and CCWD intakes in the south Delta. Sand Mound Slough along the west side of Holland Tract is blocked by a tide gate at the Rock Slough confluence that permits flow only to the north during ebb tides, to prevent water and salt movement into Rock Slough from Sand Mound Slough.

Webb Tract is bordered by the San Joaquin River on the north and east, Fisherman's Cut on the west, and False River on the southwest. Franks Tract, a flooded island area, is south of Webb Tract. Net flow near Webb Tract is usually westerly, except during periods of low Delta inflow and high export volumes, when net flow reverses and water is transported into Old River and toward the CVP and SWP pumps.

Bouldin Island is bordered by the Mokelumne River on the north and west, Little Potato Slough on the east, and Potato Slough on the south. Net flow around Bouldin Island is nearly always toward the San Joaquin River. Reverse flows, during periods of low Delta inflow and high export volumes, occur only in Potato Slough (reverse flow to the east) along the southern edge of the island.

Existing irrigation diversions and agricultural drainage discharges probably have minor effects on adjacent channel hydrodynamics. Hydrodynamic effects of these diversions and discharges are small compared with tide-induced fluctuations in water surface elevation, velocity, and channel flow.

WATER QUALITY

The Delta is an important habitat area for numerous species of fish and aquatic organisms, as well as a source of water for municipal, agricultural, recreational, and industrial uses. Dominant water quality variables that may influence habitat and food-web relationships in the Delta are temperature, salinity, turbidity (and associated light levels), DO, pesticides, pH, nutrients (nitrogen and phosphorus), DOC, chlorophyll, and mercury.

A summary of key Delta water quality values in Delta inflows and exports as well as potential water contaminants on the project islands was provided in the 2001 FEIS (Chapter 3C). Based on new information, a new summary for mercury and an updated discussion of DOC are included here.

The Delta export pumping plants (SWP Banks, CVP Tracy, and SWP North Bay Aqueduct) and CCWD diversions at Rock Slough, Victoria Canal, and Old River supply a combination of agricultural and municipal users and some wildlife uses (CVP water supply for refuges). The City of Antioch diverts water when salinity is low enough during high outflows, and the City of Stockton has an intake on the San Joaquin River at Empire Tract. CCWD has an intake located on Victoria Canal (Middle River intake) that connects to the Los Vaqueros pumping plant on Old River. Industrial intakes and discharges occur near Sacramento, Stockton, and Antioch. A wide variety of fish and wildlife inhabit or migrate through the Delta. Many public and private recreational facilities are located in the Delta.

Water quality conditions in the Delta are influenced by natural environmental processes, water management operations, and waste discharge practices. The project would provide an additional method of water management in the Delta and thus would influence Delta water quality. Water quality variables that might be affected by project operations have been identified and selected for effect assessment purposes. Some of the selected variables are assessed with models and are discussed quantitatively in the effect assessment. Others cannot be assessed with models and therefore are discussed qualitatively. Variables that have not been identified as current problems in the Delta and those that are not likely to be affected by project operations were not further evaluated.

Delta water quality conditions can vary dramatically because of year-to-year differences in runoff and upstream water storage releases, and seasonal fluctuations in Delta flows. Concentrations of materials in inflowing rivers are often related to streamflow volume and season. Transport and mixing of materials in Delta channels are strongly dependent on river inflows, tidal flows, agricultural diversions, drainage flows, wastewater effluents, exports, and power plant cooling water diversions and discharges.

Water quality objectives and concerns are associated with each beneficial use of Delta water. Beneficial uses in the Delta consist of agriculture, municipal (e.g., drinking) and industrial water supply, fish and wildlife, and recreation. Water is diverted for agricultural crop and livestock production at more than 1,800 siphons and pumps. Drainage water is returned to the Delta through about 200 larger pumping stations operated independently by farmers and reclamation districts.

Project operations could affect water quality in the same general ways as described and evaluated in the 2001 FEIS (Chapter 3C). Diverting water onto the project islands would reduce Delta outflows. As a result, brackish water from Suisun Bay would intrude into the central Delta and salinity in Delta channels and exports would increase. Releases from Reservoir Islands for increased Delta outflow in the fall of some years would reduce salinity intrusion and reduce export salinity. Possible water quality effects of the project depend on flows in the Delta. An accurate assessment of possible Delta water quality effects therefore requires consideration of the patterns of Delta channel flows.

While water is stored on the Reservoir Islands, salinity and DOC concentrations could increase because of evaporative water losses, and DOC concentrations could increase also as a result of peat-soil leaching and aquatic vegetation or algal growth. Therefore, discharges from the Reservoir Islands could contribute to increased concentrations of salinity and DOC in Delta channels and in exports and diversions.

Salinity and Dissolved Minerals

As discussed in the 2001 FEIS, sodium concentration is an important factor in both domestic and agricultural water supply. Measurements of chloride, bromide, and EC can all be used to determine salinity. EC is a general measure of dissolved minerals and is the most commonly measured variable in Delta waters. EC is generally considered to be a conservative parameter that is not subject to sources or losses internal to any particular water body. Therefore, changes in EC values can be used to interpret the movement of water and the mixing of salt in the Delta. Chloride and bromide are also factors that are considered in domestic water quality. The ratio of chlorine to EC can be used to distinguish sources of water from different inflows sampled at different Delta locations.

Mercury

The 2010 303(d) list of impaired waterways in California identifies the Delta as impaired by elevated levels of mercury (U.S. Environmental Protection Agency 2011). Mercury, particularly methylmercury, accumulates in aquatic organisms. In the Delta, fish tissues have been found to contain elevated levels of this neurotoxin. Much of the mercury in the Delta originates from sediments contaminated by historic mining activities in the tributaries to the Delta. These tributaries still contain elevated levels of mercury as a result of mining activities and continue to contribute to the elevated levels in the Delta.

Because methylmercury is of much greater concern for bioaccumulation than inorganic mercury, the production of methylmercury from inorganic mercury is considered detrimental. This conversion is most commonly performed by sulfate-reducing bacteria. Conditions that affect these bacteria, such as temperature and pH, also affect the amount of methylation that occurs. (Wood et al. 2010a:23.)

It has been estimated that 60% of the methylmercury in the Delta originates from tributary inflow and 40% originates from in-Delta sources. Of the in-Delta sources, most comes from the sediments of wetlands and open water. Relatively small amounts come from agricultural drains and wastewater treatment plants. (Wood et al. 2010b:33.) However, the production of methylmercury is difficult to measure in the field, and there appears to be considerable variability in the estimates of methylmercury production by wetlands and agricultural land.

Methylmercury loads from Delta agricultural lands with high organic content have been estimated as being between 0.3 and 4.5 nanograms per square meter per day (ng/m2/day) (Heim et al. 2009:33; Wood et al. 2010a:108). In contrast, methylmercury loads from open water in the Delta have been estimated using benthic flux changers to be 10 ng/m2/day (Wood et al 2010a:88). Mercury flux from some wetlands has been estimated to be similar to this rate. For example, a study from the Twitchell Island East pond estimated a mercury flux of 7.7 ng/m2/day (Sassone et al. 2008:10) and even lower values have been estimated for wetlands on Grizzly Island (Stephenson et al 2008:8). Measured values of methylmercury production on wetlands appear to be highly variable and dependent on many factors such as timing and nature of inundation (permanent, seasonal, or tidal). In some other cases, wetlands have been estimated to be methylmercury sinks (Wood et al. 2010a:30).

In 2011, the Central Valley RWQCB adopted the Delta Methylmercury TMDL, which includes biological and water column objectives (Central Valley Regional Water Quality Control Board 2011). California is also in the process of developing a methylmercury TMDL for reservoirs across the state, which includes consideration of aerial deposition of mercury in driving MeHg levels.

In order to attain the TMDL goal, allocations have been assigned to the various sources of methylmercury in the Delta. The project islands are mostly in the central Delta region. The methylmercury load allocation for the central Delta is to maintain the current estimated level of 37 grams per year (g/yr) for agricultural sources plus 210 g/yr for wetland sources and 370 g/yr for open water (Central Valley Regional Water Quality Control Board 2011:Table A).

The TMDL will be implemented in two phases. During phase 1, concentrations of methylmercury will continue to be measured at locations within the Delta and procedures for reducing methylmercury load will be assessed. After the completion of phase 1, load allocations will be re-assessed and approved control actions will be implemented to meet allocation targets (Central Valley Regional Water Quality Control Board 2011:2).

Dissolved Organic Carbon

Minimizing DOC concentrations in the raw water source is a water quality goal in order to reduce the DBP concentration in treated drinking water from the Delta. Project discharges may directly influence DOC concentrations in Delta channels and exports. The 2001 FEIS evaluation is updated herein with new DOC information from several recent California Department of Water Resources (DWR) and U.S. Geological Survey (USGS) studies. Project effects on export DOC would be restricted through a program of measurements, modeling comparisons, and project discharge adjustments in the WQMP to prevent any significant effects.

DOC is a major concern because DOC may be produced and leached from peat soils into the stored water on the Reservoir Islands or into the wetlands on the Habitat Islands. The rate of DOC production and leaching that can be expected on flooded peat islands is uncertain. When a field becomes flooded, the initial release of DOC may be high because of high amounts of soluble DOC in the soil and the presence of dead plant material that could provide an additional source of DOC. DWR has investigated DOC as part of its Integrated Storage Investigation of In-Delta storage. One report concluded that the maximum DOC leaching would occur when islands are first flooded, and that the rate of DOC leaching would decrease over time (Reddy 2005:3).

DOC loading rates (i.e., grams of DOC per land area per time) from peat soils are controlled by various factors, such as temperature, anaerobic conditions, soil peat content, and vegetation. Agricultural crop production, wetland habitat, and flooded island conditions may result in different DOC loadings.

Summary of Dissolved Organic Carbon Loading Information from the 2001 FEIS

DOC measurements and DOC loading rates evaluated for the 2001 FEIS showed that DOC concentrations at the export locations averaged 3.7 mg/l, with 85% of the measured values in the range of 2.5 to 6 mg/l.

The 2001 FEIS summarized the loading estimates for agricultural drainage, seasonal wetland, and flooded island conditions that were presented in the 1995 DEIR/EIS. This information was obtained from the Twitchell Island

and Special Multipurpose Applied Research Technology Station (SMARTS) experiments, and presented at the SWRCB water right hearing for the project by expert witnesses. For purposes of comparison, all estimates have been reported as grams of DOC per square meter per year (g-C/m2/yr).

Agricultural Drains

The purpose of the agricultural drainage DOC data analysis was to estimate annual loading of DOC from existing agricultural operations. These estimates provide a baseline DOC loading level for the project effect analysis.

There are two general ways to estimate the observed DOC loads (expressed as g-C/m2/yr) from the agricultural islands in the Delta:

- Multiply the annual drainage volume (expressed as water depth in meters [m]) by the average DOC concentration (mg/l) of the drainage water to estimate the DOC load.

- Multiply the DOC concentration increase observed between the Sacramento and San Joaquin River inflows and the export locations by the export flow to estimate the increased mass of DOC. This increased mass (g) of DOC then is divided by the area of the Delta agricultural islands contributing to the export water to estimate the average load of DOC.

Both methods have been used to evaluate the DOC load from Delta agricultural islands under existing conditions. Appendix G, "Water Quality Assessment Methods," of the 2000 RDEIR/EIS presents detailed information on agricultural drainage water quality for Bacon Island, Webb Tract, Bouldin Island, Holland Tract, and Twitchell Island and is incorporated herein by reference. Based on these estimates and on model calibration results, an average of 12 g-C/m2/yr was used in the 2001 FEIS for the DOC loading estimate for existing agricultural drains in the Delta.

Seasonal Wetlands and Flooded Islands

Several experiments were conducted for the project to assess DOC loading under seasonal wetland and reservoir operations (see Appendix C3 of the 1995 DEIR/EIS, which is incorporated herein by reference). The methods and results of these experiments were challenged at the SWRCB water right hearing and in comments on the 1995 DEIR/EIS. Because this is very important for assessing the likely DOC effects from the project, a summary of the measurements and a discussion of challenges to those results are provided here.

In the wetland demonstration experiment, a portion of Holland Tract was flooded, and a shallow flooded wetland habitat (0.5-meter deep) was created. Water samples were collected for approximately 3 months, and a DOC load was estimated. The wetland demonstration project estimated a total DOC load of 7 to 17 g-C/m2/yr. In addition, a second experiment was conducted to ascertain the DOC load generated from the decay of wetland plants. Wetland plant decay experiments suggested a load of 5.1 to 7.5 g-C/m2/yr. Compared to agricultural conditions, wetlands may provide lower DOC loads because the peat soil of wetlands generally will be moister and less aerobic than that of agricultural soils. However, a seasonal wetland loading of 12 g-C/m2/yr was assumed, equivalent to the assumed agricultural drainage load.

Additional experiments were conducted to assess DOC loading under project reservoir operations. At the demonstration wetland on Holland Tract, loading was estimated for an extended period of time when a seasonal wetland was deep-flooded (to approximately 0.8 m) to characterize possible reservoir operations. In this experiment, the overall DOC load was estimated from the combined flooded wetland and water storage periods at the Holland Tract wetland demonstration project. The result was an estimated DOC load of 21 g-C/m2/yr.

In 1991, Tyler Island was flooded for approximately 1 month. DOC loading was estimated based on collected water samples. The Tyler Island experiment resulted in an estimated total DOC load of 30 to 36 g-C/m2/yr. Much of the DOC loading was probably the result of the cornfield vegetation residue and oxidized surface peat soil.

Parties to the SWRCB water right hearing questioned the validity of these experimental results. CUWA, CCWD, and others argued that the Holland Tract flooded wetland experiment was too short; they said that it was unclear whether DOC had started to level off or not, and that the reported DOC loading was therefore underestimated.

DWR conducted several DOC investigations at SMARTS, a peat soil DOC testing facility managed under the Municipal Water Quality Investigations (MWQI) program. The facility was constructed in 1988 and consists of eight large tanks for conducting inundated peat soil water quality studies under static or water-flow conditions. Two reports from SMARTS studies have been prepared (California Department of Water Resources 1999a, 1999b) and are referred to below as SMARTS 1 and SMARTS 2. Results from SMARTS 1 and 2 were evaluated in the 2001 FEIS and are summarized here.

SMARTS 1 was a 12-week experiment (July 15 to October 7, 1998), and SMARTS 2 was a 27-week experiment (January 21 to September 15, 1999). The experiments used two water-flow conditions: “static” and “flushing.” The flushing tanks were not evaluated in the 2001 FEIS because of difficulties associated with measuring small concentration changes in these tanks. The four static tanks were refilled as needed to compensate for evaporation losses, so the water level was held constant. The surface water in the static tanks was mixed with submersible pumps. The water and peat depth for the four static tanks varied; the water depth was either 2 feet (0.6 meter) or 7 feet (2.1 meters), and the peat depth was either 1.5 feet or 4 feet.

Because the water depth was held constant in the static tanks, the load (grams per square meter [g/m2]) for a static tank can be estimated as the change in DOC concentration (mg/l [equivalent to g/m3]) times the depth of water (m). These calculations result in loading estimates of 24 to 32 g/m2 for the static tanks with 1.5 feet of peat (tanks 1 and 7) and 53 to 54 g/m2 for the static tanks with 4 feet of peat in SMARTS 1 (tanks 3 and 5). The SMARTS 2 experiment resulted in a wider range of DOC load estimates because the peat soil pore-water DOC concentrations varied considerably. The SMARTS 2 experiment data for week 27 indicated that the DOC load from the higher DOC peat soil (tanks 1 and 3) was 73 to 121 g/m2, and the DOC load from the lower DOC peat soil (tanks 5 and 7) was 23 to 42 g/m2. The SMARTS 2 experiments showed that the peat soil (pore-water) DOC and the surface-water DOC concentrations do not continue to increase during longer submergence as rapidly as during the initial 3 months of submergence.

The SMARTS 2 peat soil DOC concentrations were considerably higher (ranging from 350 to 600 mg/l) than DOC concentrations that have been measured in Delta peat soils. Samples of pore water collected at the soil surface and at a depth of 2 feet from the demonstration wetland site on Holland Tract in 1992 yielded DOC concentrations between 24 and 71 mg/l with an average of 55 mg/l (n=9). Soil-water samples collected from an agricultural field on Holland Tract in 1992 included measured DOC concentrations between 41 and 240 mg/l with an average of 141 mg/l (n=9). It should be noted that the higher DOC concentrations in the SMARTS 2 study may be attributed in part to the character of the source material and the temperature of the pore water during the study. The source material was highly oxidized peat taken from the surface of an actively farmed field on Bacon Island, which is not representative of a 1.5- or 4.0-foot-deep soil profile. Also, the temperatures of the pore water at the SMARTS facility in Davis regularly exceeded the temperatures expected on the project islands in the more moderate Delta climate. Both factors contributed to higher carbon loading rates. The observed DOC loads in the SMARTS experiments were proportional to the depth of the peat soil and the DOC concentration of the peat-soil pore water. DOC loading of flooded agricultural peat soils on the project islands likely would be proportional to the depth of oxidized peat soil on the islands.

New Dissolved Organic Carbon Loading Information

Additional information about DOC loading from wetlands and flooded islands is directly pertinent to the Habitat Islands. Additional studies at the SMARTS facility during 2002-2005 and measurements from the June 2004 Jones Tract flooding provide new information about DOC release rates for situations similar to the project Reservoir Islands that are presented below.

Because DOC is measured in the Sacramento River, San Joaquin River, and at the Delta exports, it is possible to estimate how much of the DOC originating at the Delta exports originates within the Delta. In one study (Stepanauskas et al. 2005:139), it was estimated that an average of 30% of the DOC at the exports originates from within the Delta. The agricultural drainage flow and DOC concentrations can be measured or estimated; the open water and wetlands contributions must be estimated as the incremental DOC at the exports that cannot be explained by the measured sources (river inflow and agricultural drainage).

Under current conditions, the project islands contribute moderately to the total DOC load from agricultural drains at the exports. The four project islands are within the area that DWR considers as having relatively high concentrations of DOC in its agricultural drains (15–36 mg/L). DWR has used the DSM2 model and estimates of island drain flows and DOC concentration to determine that island drains contribute an average of about 35% of the DOC at the SWP and CCWD intakes, and about 25% at the CVP intake (California Department of Water Resources 2003b). The average DOC concentration estimated for the SWP from assumed river inflow DOC concentrations without any Delta DOC sources was 2.6 mg/l. The simulated increase in DOC at the SWP pumps with the assumed agricultural drainage DOC concentrations and drainage flows (from DICU sub-model) was 1.3 mg/l. Some of the Delta sources of DOC also would flow out of the Delta.

A good summary of DOC load rates evaluated in various studies of agricultural drains was provided in another study in 2007 (Deverel et al. 2007). Summer DOC loading rates for Orwood Tract, Sherman Island, and Twitchell Island ranged from 0 to 10 g-C/m2. Summer DOC loading rates for Jersey Island were considerably higher (75 g-C/m2 /yr), presumably because the field was not drained completely until summer. Winter loading rates, December–April, were recorded at fewer locations and varied from 2-45 g-C/m2. The annual loading rate measured from Staten Island during water year 2006 (DiGiorgio et al. 2006) was 8.5 g-C/m2/year. These are also similar to the 12 g-C/m2 assumed in the 1995 and the 2000 RDEIR/EIS assessments.

Wetlands

In a 2001–2003 study of wetlands on Twitchell Island (Fleck et al. 2007), DOC concentrations in surface water were found to be less than the DOC concentrations in water moving through the soil into the drainage system, despite the presence of anaerobic conditions in the soil. This study used a water and DOC balance approach to account for inflow, inflow DOC, outflow, and outflow DOC. The estimated loading rate from the surface water was estimated to be 25 g-C/m2/yr from the surface drainage compared to 100 g-C/m2/yr for the subsurface drainage. The Twitchell Island study found that the DOC in the surface water was derived mostly from plants and algae, with plants being the more likely source (Fleck et al. 2007:12-13). This determination was based on the difference in chemical properties between the shallow pore-water and the surface water.

Flooded Peat Soil

Two sets of measurements provide relevant new information for estimating DOC loading rates from flooded peat islands. One was the analysis of data collected from Jones Tract after it was flooded in June 2004, and the other was a series of multi-year tank experiments at the DWR SMARTS facility from 2002 to 2005.

The 2002–2005 SMARTS experiments measured the release of TOC and DOC from the same peat soil for multiple years, allowing an assessment of how flooded Delta islands DOC release loads may decrease through time. Peat soil from a field on Bacon Island was placed in the tanks to a depth of 0.5 m and covered with 1.4 m or 2.8 m of water in March 2002. The results from the first year were described in a DWR report (California Department of Water Resources 2003a:Chapter 3), and the results from the first 2½ years were evaluated for the In-Delta Integrated Storage Investigations (Reddy 2005). The 2002–2005 SMARTS experiment data were obtained from DWR for further evaluation in this SEIS.

During the first 2 years of the experiment, water levels in the tanks were adjusted periodically to reflect the expected seasonal storage on in-Delta Reservoir Islands. Because a substantial portion of the water was removed in both 2002 and 2003, the DOC loading estimates (water depth x concentration) are more uncertain than for static tanks. TOC and DOC measurements were made for the first 3 years, but only TOC was measured in 2005. DWR reported that DOC was about 95% of TOC in the 2002 and 2003 measurements. DWR recorded the water depth in each tank, as well as the water removed and added (or exchanged in 2003) to track the cumulative TOC loading.

Exhibit 3.11-1 shows the measured water depths and the exchange depths (tank water replaced with river water) for each TOC measurement date. TOC concentrations measured at each sampling date are shown in the bottom panel. The reported depths were always the same in the four deep and four shallow tanks. Slight variations in depths (especially for the shallow tanks) might account for some of the variations in TOC concentrations and corresponding TOC release loads. Nevertheless, the 4 years of TOC measurements provide the best available demonstration of long-term peat soil TOC release rates.

The measured TOC was about 3 mg/l on March 12, 2002 after the tanks were filled with 0.5 m of peat soil and with Sacramento River water. The TOC concentrations increased to about 25 mg/l in the deep tanks (2.5 m) and to about 50 mg/l in the shallow tanks (1.25 m) by July 17 (after 4 months). Then most of the water was removed from the tanks (to a depth of about 0.3 m). TOC concentrations increased rapidly during the summer months because of the shallow depth and high temperatures of the tanks. The water depth was held constant by adding river water to balance evaporation, but the summer TOC concentrations in the shallow water increased to maximum concentrations of 100 to 200 mg/l, as measured on October 1. The seasonal TOC release pattern was determined from the cumulative TOC release load, calculated as the depth times the concentration (plus the removed TOC loads when the water depth was reduced in 2002 and 2003).

Exhibit 3.11-2 shows the cumulative TOC release load (g-C/m2) calculated by DWR, accounting for the removal and exchange of water from each tank. The changes in TOC release loads during the 4-year experiment are shown in the bottom graph, by starting the annual TOC release load at zero on the first measurement date for each year. The decreasing annual TOC release loads demonstrate the basic results from the 4-year SMARTS experiment, suggesting that there was a large initial TOC release from the accumulated DOC in the oxidized peat soil (pore water), but that the release of TOC from the flooded peat soil was substantially reduced in subsequent years.

The TOC release load decreased substantially from 2002 to 2005. The calculated annual TOC release loads were about 80 to 100 g-C/m2 for the eight tanks during the first year (2002). The experiment did not begin until March 12, so the possible TOC release in January and February is unknown. There were five sample dates but no additional TOC release loads from October to December of 2002. In this first year, the TOC release rate appeared to follow a seasonal pattern, with a much lower release rate in the October–December period (colder) than in the April–September period. The variable water depths and uncertain water exchanges during 2003 make the TOC release loads uncertain. However, the annual TOC release loads calculated by DWR for 2003 (with exchange depth in meters) ranged from about 40 to 80 g-C/m2. The TOC concentrations and calculated release loads were most variable in 2003 after the water depths were reduced. The TOC release rates measured in October–December of 2003 were again low.

The annual estimated TOC release loads were reduced substantially in 2004 (third year) to about 20 to 40 g-C/m2. The estimated annual TOC release loads for 2005 were again very low and were uncertain because the water level (and TOC concentrations) fluctuated from rainfall and evaporation, with some added water in the summer months. The TOC concentrations in the deep tanks (2.8 m) remained about 25 mg/l throughout the year, and the TOC concentrations in the shallow tanks (1.4 m) remained about 50 mg/l throughout the year. The annual TOC release loads calculated from the changes in TOC concentration in 2005 were about 10 to 20 g-C/m2. These calculated TOC release loads in the fourth year of the flooded peat soil experiment were similar to the measured DOC loads from existing agricultural drainage in the Delta.

Determining what portion of the annual TOC release loads was caused by leaching of the initial soluble pore water DOC and what portion was new production of DOC from the microbial decay of flooded peat soil material was not possible from this experiment. However, it appeared that the majority of the cumulative TOC release loads occurred during the first 2 years. Much lower TOC release loads were measured in the third and fourth years, suggesting that TOC release loads would likely decrease with time as the in-Delta Reservoir Islands are converted from agricultural production and become inundated. Maintaining shallow wetlands or saturated conditions on the Reservoir Islands likely will minimize the production and release of DOC from the peat soil.

Flooded Jones Tract Measurements

On June 3, 2004, a section of the Middle River levee on the western side of Upper Jones Tract failed, opening a 300-foot-wide levee breach. Within a week, both upper and lower Jones Tracts were flooded. By late June, the breach in the levee was mostly filled and the tidal exchange of water with Middle River ceased. Pump-off of the flooded water began on July 12, and most water was removed by early December 2004. The DWR water quality data from the Jones Tract flooding event recently have been reported and discussed (California Department of Water Resources 2009). The available Jones Tract data were obtained from DWR for further evaluation in this EIS.

TOC, DOC, and EC data (and many other parameters) were collected by DWR from flooded Jones Tract throughout this Delta peat soil island flooding event. The evaluation of these water quality data provides important new information about potential DOC release rates from the project storage islands. The DOC release rates on Jones Tract may have been higher than those that would be expected from the project storage islands because the Jones Tract flood inundated soils and crops that had been recently plowed and planted. Nevertheless, the DOC measurements collected during this 2004 peat soil island flooding event can be used to better estimate the likely DOC release loads from the project Reservoir Islands. Bacon Island is across Middle River channel from Lower Jones Tract, and Webb Tract has similar subsided elevations and peat soil depths.

An initial DWR modeling report was prepared in 2005 to assess potential increases in DOC at the SWP exports resulting from the pump-off of Jones Tract water (Mierzwa and Suits 2005:3-2). The DSM2 Delta hydrodynamic and water quality model was used by DWR for this investigation. A constant DOC release rate of 0.5 g-C/m2/day was assumed for June–October (with 0 g-C/m2/day release rate for November and December). The total assumed DOC release load therefore was about 75 g-C/m2 for this DSM2 modeling study. This assumed constant DOC release rate of about 15 g-C/m2/month produced simulated DOC concentrations in Jones Tract that were lower than the measured DOC data in June and July, roughly matched the measured DOC in August and September, but were higher than the measured DOC concentrations in October and November. A maximum concentration of 30 mg/l was assumed for October and November. Pump-off was completed in mid-December.

Exhibit 3.11-3a shows the most representative DOC data from Jones Tract, which were 24-hour composite samples from the Upper and Lower Jones Tract pumps, collected 1–3 days each week from mid-July to late November. The increase in these measured DOC concentrations combined with the estimated water depth (decreasing with pump-off) were never used by DWR to estimate the Jones Tract DOC release rates through time (i.e., monthly). The Jones Tract Flood water quality report (California Department of Water Resources 2009) discussed seasonal DOC release rates, but never estimated the Jones Tract monthly DOC release loads. The DOC load (g-C/m2) on a flooded island (or tank) is calculated as the DOC concentration (mg/l) times the water depth (m). The DSM2-simulated DOC release rate of 0.5 g-C/m2/day for the June–October period gave DOC concentrations that were too high as the water depths on Jones Tract were reduced during the pump-off period. The Jones Tract Flood water quality report also describes this initial DOC release rate, without clearly describing the reduction in release load that was observed as the water depths decreased.

A daily spreadsheet model for the Jones Tract flooding DOC release and pump-off was developed for this Place of Use EIR, based on the initial DSM2 modeling and additional information about the Jones Tract area and volume, based on 2007 Lidar (topography) data collected by DWR for the Delta islands. DWR also collected water surface elevation data during the pump-off, which was used to calculate the daily drawdown volume. The actual geometry data and daily drawdown elevation allowed several adjustments in the initial DSM2 modeling. The combined volume of Upper and Lower Jones Tract at the average tidal elevation of about 1.5 feet above mean sea level (msl) when pump-off began was about 150,000 acre-feet (af) rather than the 180,000 assumed in the DSM2 modeling. This reduced the assumed initial mean depth from about 15 feet (4.6 m) to about 12.5 feet

(3.8 m). The measured Jones Tract DOC concentrations therefore represent a lower DOC release rate during the flooded period.

Exhibit 3.11-3b shows the estimated mean depth, evaporation, and discharge for Jones Tract during the pump-off. The DSM2 modeling did not consider evaporation from Jones Tract. Some of the measured DOC concentration increase was caused by evaporation and not by DOC release from the peat soil. Evaporation for July–November was calculated from daily DWR California Irrigation Management Information System (CIMIS) (meteorological station) estimates and the daily water surface area of Jones Tract as it was pumped-off to be about 18,500 af, about 12% of the flooded volume of 150,000 af.

Exhibit 3.11-4a shows the measured EC on Jones Tract and the calculated EC for the estimated evaporation during the Jones Tract pump-off period. The evaporation estimate was confirmed by the EC measurements which increased by about 20% from about 350 µS/cm when the pump-off began in mid-July to about 425 µS/cm at the end of October. This suggests that a similar 20% increase in the initial DOC of about 10 mg/l (when the breach was closed) would have resulted from evaporation, slightly reducing the estimated DOC release load. This evaporation volume would not have been discharged to the export pumps.

Exhibit 3.11-4b shows the estimated monthly DOC release rates (g-C/m2/day) and the corresponding DOC concentrations for Upper and Lower Jones Tract during the 2004 flooding and pump-off period. The daily spreadsheet model accounts for the effect of tidal exchange during June, before the levee breach was repaired. The tidal flows would have exchanged some of the Upper Jones Tract DOC with Middle River DOC (of about 3 mg/l), reducing the apparent DOC release rate for Upper Jones Tract. Based on the tidal fluctuation of about 4 inches, a daily exchange of about 10% of the Upper Jones volume was assumed. The Lower Jones Tract DOC increased more rapidly during June, which may have been caused by this tidal exchange (i.e., reduction) of DOC from Upper Jones Tract. This tidal exchange increased the DOC release rate estimated for June to match the measured Upper Jones Tract DOC concentrations.

The results from the daily spreadsheet calculations of Upper and Lower Jones Tract DOC from assumed monthly DOC loading and the actual elevation, volume, area, evaporation, and pump-off discharge flow match the measured DOC data quite well. The monthly DOC release rates shown in Exhibit 3.11-4b were assumed to be the same for Upper and Lower Jones Tract. The DOC release rates (g-C/m2/day) were estimated (by matching the measured DOC concentrations) to be 0.75 in June, 0.5 in July, 0.25 in August, 0.15 in September, 0.10 in October, and 0.05 in November and December. The total estimated release of DOC from Jones Tract during this 7-month period was 56 g/m2/day. This estimated Jones Tract DOC release was only about 75% of the DWR DOC release load estimate of 75 g/m2 used in the initial DSM2 modeling, and much less than the 8-month growing season DOC release rate of 0.5 g-C/m2/day (corresponding to a seasonal load of 120 g-C/m2) described in the Jones Tract flood water quality report (California Department of Water Resources 2009). The major differences in the initial DSM2 modeling were the high volume and depth estimates, and the neglecting of evaporation. The estimated Jones Tract DOC release load for June–November of about 56 g-C/m2 was considerably less than the first year DOC release load of 80–100 g-C/m2 calculated from the SMARTS tanks in 2002.

Exhibit 3.11-5a shows the daily CVP and SWP combined export pumping and the corresponding TOC increments that were estimated from the Jones Tract discharge, calculated as the Jones Tract DOC minus the export DOC without the Jones Tract discharge times the fraction of the exports from the Jones Tract discharge. Because the DSM2 modeling assumed a volume of 180,000 af, the estimated DOC increment at the pumps was about 2 mg/l in October, November, and the first half of December. The daily spreadsheet model indicates that the most likely DOC increment would have been about 1 mg/l in September, October, and November. The fraction of the exports coming from Jones Tract would have been about 8% in July and would have decreased to about 5% in November.

Exhibit 3.11-5b shows the measured DOC at the SWP Banks export pumps during June–December 2004. DWR operates elaborate "wet-chemistry" field measurement equipment for DOC and TOC at this important location. Multiple measurements are collected each day, and grab samples are analyzed for confirmation of the field equipment. The DOC concentrations were generally about 3 mg/l in July and increased slowly to about 4 mg/l in

November. These are very uniform export DOC measurements, reflecting the Sacramento River DOC concentrations (not shown) that were about 2 mg/l from June through mid-October, and then increased to about 3 mg/l in late October and November, following the first runoff event. The DOC concentrations measured in the San Joaquin River (not shown) were 3–4 mg/l from June through mid-October, and increased slightly to between 3 and 5 mg/l (more variable) in November and December. The DOC at the exports was a blend of Sacramento River water, San Joaquin River water, and some Delta agricultural drainage water. Natural variations in these source water DOC concentrations cause considerable variation in the export DOC concentrations.

The Jones Tract DOC release load that was observed in 2004 of about 56 g-C/m2 provides the best estimate of the likely first-year DOC release from Bacon Island and Webb Tract during water storage of about 6 months. This Jones Tract flooding event, with a storage volume of 150 thousand acre-feet (taf) and a discharge volume of about 130 taf, was very similar to the DOC release and incremental DOC concentrations that likely would occur at the export pumps during the first year of project storage water that is discharged for export. However, because the water depth on Bacon and Webb Tract will be deeper, the expected DOC concentrations (for the same Jones Tract DOC release rate of 56 g/m2) would be lower. The initial Jones Tract mean depth (at elevation of 1.5 feet msl) was about 12.5 feet (3.8 m). The mean depth for Bacon Island (filled to a maximum elevation of 4 feet msl) would be about 5.5 m, and the mean depth of Webb Tract would be about 6.25 m. Therefore, the discharge DOC likely would be about 13 mg/l for Bacon Island (i.e., 56/5.5 + 3) and about 12 mg/l for Webb tract (56/6.25 + 3).

These are moderate DOC concentrations for the project storage water that can be discharged for exports within the WQMP criteria and guidelines. An estimated DOC increment of 1 mg/l from project discharges is the major DOC criterion in the WQMP; higher DOC increments would require additional evaluation and approval. The actual Jones Tract flooding and discharge produced DOC increments at the export pumps that were similar to what might be expected for the first-year project discharges. As demonstrated by the SMARTS results, the initial DOC release rate from flooded peat soil likely would be reduced considerably in subsequent years of operation.

If the initial DOC release rates from Bacon Island and Webb Tract actually are higher than the Jones Tract flooding data would indicate, some discharge of the project storage water for Delta outflow after the first year of inundation might be necessary to reduce the DOC effects at the exports. These possible first-year operating procedures to reduce the DOC effects were anticipated in the WQMP. The Jones Tract DSM2 and spreadsheet modeling described above and included in Exhibit 3.11-5b are representative of the methods required by the WQMP monitoring and operating procedures for tracking and managing the incremental DOC effects of the project.

The 2001 FEIS considered a large range of potential DOC release rates, based on available measurements and testimony. Values used in the effect assessment ranged from about 120 g/m2/year for initial reservoir operations (first years) to 24 g/m2/year for long-term reservoir operations. These recent results from the 2002–2004 SMARTS measurements and the Jones Tract flooding DOC data indicate that the first year DOC release from Jones Tract was less than 60 g/m2/year, about half the assumed first year value of 120 g/m2/year. By the third year of the SMARTS experiment (2004), the loading rate had dropped to less than 40 g/m2/year. Long-term use of the Reservoir Islands might reduce the DOC release to below 40 g/m2/year, but the long-term DOC release load remains uncertain. The SMARTS tanks were filled with agricultural peat soil scraped from the surface, and the Jones Tract flooded following spring disking and planting, whereas the project storage islands would be flooded with minimal vegetation and without disturbing the soil of the reservoir surface; project operations should result in lower DOC levels.

Temperature and Turbidity

As discussed in the 2001 FEIS, water temperature concerns for this project are primarily related to fish. Temperature governs the rates of various biochemical processes, and fish growth, activity, and mortality are related to temperature. One of the primary temperature influences on fish is related to DO, because the concentration of DO in water changes as the temperature changes. That is, reduced DO is available to fish at higher water temperatures, and increased DO is available to fish at lower water temperatures. (A detailed discussion of studies regarding fish growth and mortality related to temperature is presented in Section 3.4, “Aquatic Resources.”) Water temperatures are determined primarily by surface heat exchange processes, which are a function of weather. Localized water temperature effects on aquatic organisms, particularly fish species, may also occur from discharges of water where the temperature of the water being released is substantially higher than the receiving water (i.e., “thermal shock”). Project water discharges may locally affect water temperatures because stored water may become warmer during storage periods.

As discussed in the 2001 FEIS, the presence of suspended sediments (measured as turbidity) is a general indicator of surface erosion and runoff into water bodies or resuspension of sediment materials. Following major storms, water quality is often degraded by inorganic and organic solids that are resuspended or introduced in runoff. The attenuation of light in Delta waters is controlled by suspended sediments (with some effects from chlorophyll). Suspended sediments are often elevated in the saline estuarine environment as a result of increased aggregation of particles. High winds and tidal currents also contribute to increased suspended sediments in the estuarine zone. Decreased visibility in Delta waters as result of increased suspended sediments (i.e., turbidity) can have adverse effects on fish. The Reservoir Islands are expected to act as settling basins; therefore, project-related discharges of suspended sediments are expected to be considerably lower than the Delta channels. However, resuspension of suspended sediment materials from the reservoir bottoms into the water on the Reservoir Islands is possible and might have an effect on Delta channel concentrations. As the Reservoir Islands are emptied, the discharge water may have higher suspended sediment concentrations.

Since the 2001 FEIS was prepared, the WQMP and FOC developed as part of the BOs have been incorporated into the project. The WQMP and FOC include monitoring and operational criteria for temperature and turbidity.

Trihalomethanes

Different types of trihalomethanes have industrial uses as solvents or refrigerants, and many are considered carcinogenic. THMs also occur in drinking water as a result of chlorine treatment for disinfectant purposes and, therefore, are also known as "disinfection byproducts." In this case, THMs are formed when chlorine reacts with naturally occurring organic material found in water such as decaying vegetation. Since the 2001 FEIS was prepared, the WQMP has been incorporated into the project. The WQMP includes operations criteria for estimated effects at treatment plants. Project operations may not cause the modeled THM concentration (e.g., using regression equations for TOC) at any treatment plant using Delta water to be greater than 80% of the established maximum contaminant level.

3.11.3 Regulatory Framework/Applicable Laws, Regulations, Plans, and Policies

Federal applicable laws and regulations are provided because they are required under NEPA. State applicable laws and regulations are provided for informational purposes and to assist with NEPA review. USACE has considered applicable state, regional, and local plans and ordinances as a part of the environmental review process for this SEIS, where applicable.

Federal

Rivers and Harbors Appropriation Act of 1899

The Rivers and Harbors Appropriation Act of 1899 (commonly known as the Rivers and Harbors Act) addresses activities that involve constructing dams, bridges, dikes, or other obstructions across any navigable water. Placement of any obstruction to navigation outside established Federal lines, or excavation from or deposit to material in such waters, requires a permit from USACE. Navigable waters are defined in 33 CFR 329.4 as follows:

> Those waters that are subject to the ebb and flow of the tide and/or are presently used, or have been used in the past, or may be susceptible for use to transport interstate or foreign commerce. A determination of navigability, once made, applies laterally over the entire surface of the waterbody, and is not extinguished by later actions or events which impede or destroy navigable capacity.

Section 10

Section 10 (33 U.S. Code 403) prohibits the unauthorized obstruction or alteration of any navigable water of the U.S. Construction of any structure in or over any navigable water of the U.S., or the accomplishment of other work affecting the course, location, condition, or physical capacity of such waters, is unlawful unless the work has been authorized by the Chief of Engineers.

Clean Water Act

SWRCB is the state agency with primary responsibility for implementation of state and Federally established regulations relating to water resource issues. Typically, all regulatory requirements are implemented by the SWRCB through regional boards established throughout the state. Both the SWRCB and the Central Valley RWQCB regulate water quality in the Delta.

The Clean Water Act (CWA) is the primary Federal law that protects the quality of the nation's surface waters, including lakes, rivers, and coastal wetlands. It operates on the principle that all discharges into the nation's waters are unlawful unless specifically authorized by a permit; permit review is the CWA's primary regulatory tool.

Section 303

Delta-specific beneficial uses protected through water quality objectives are municipal and domestic water supply, agricultural supply, industrial supply (process and service), recreation (water contact and non-contact), freshwater habitat (warm- and coldwater), fish migration (warm and cold water), fish spawning (warmwater fish), wildlife habitat, and navigation. Section 303(d) of the CWA established the total maximum daily load (TMDL) process to guide the application of state water quality standards. To identify candidate water bodies for TMDL analysis, a list of water quality–limited streams is generated by the SWRCB and applicable RWQCB. The water quality impairment can include the presence of a pollutant, such as a heavy metal, pesticide, or excessive sediment, or a change in the physical property of the water, such as DO or temperature.

A TMDL is a quantitative assessment that specifies the allowable load of pollutants from individual sources to ensure compliance with water quality standards. Once the allowable load and existing source loads have been determined, reductions in allowable loads are allocated to individual pollutant sources.
For the Delta, TMDLs have been established for diazinon, chlorpyrifos, pathogens (for Stockton urban waterways), low DO (in the Stockton Deep Water Ship Channel [DWSC]), and methylmercury.

The TMDL for methylmercury in the Delta was implemented through the Basin Plan Amendment process in 2011 (Central Valley Regional Water Quality Control Board 2011). Major components of the Basin Plan amendments are:

- Numeric objectives for methylmercury in fish tissue and an aqueous methylmercury goal that are specific to the Delta and an exposure reduction program;
- An implementation plan for controlling methylmercury and total mercury sources; and
- A surveillance and monitoring program.

The project islands are predominantly located within the Central Delta sub-region of the Delta. Because the ambient methylmercury concentrations in the Central Delta subarea equal or approach the proposed aqueous methylmercury goal, a load allocation has been set at the existing average annual methylmercury load in order to ensure compliance with fish tissue objectives. However, the TMDL implementation program indicates that proponents of new wetlands and wetland restoration projects scheduled for construction must (a) participate in control studies or must implement site-specific study plans that evaluate practices to minimize methylmercury discharges, and (b) implement methylmercury controls as feasible. The TMDL implementation program includes two phases of reducing methylmercury levels. Phase 1, which will continue through about 2020, emphasizes control studies and pilot projects to develop and evaluate management practices to control methylmercury and requires that all dischargers implement reasonable, feasible controls for inorganic mercury. Phase 2, which will last from approximately 2022 until 2030, will require management practices to be implemented in accordance with the schedules adopted for Phase 2 activities. (Central Valley Regional Water Quality Control Board 2011.)

Section 401

Section 401 of the CWA requires that an applicant pursuing a federal permit to conduct any activity that may result in a discharge of a pollutant obtain a Water Quality Certification (or waiver). Under the CWA, the state (SWRCB or applicable RWQCB) must issue or waive Section 401 Water Quality Certification for the project to be permitted under Section 404. Water Quality Certification requires the evaluation of water quality associated with dredging or placement of fill materials into waters of the United States and may impose project-specific conditions on development.

Section 402

Section 402 of the CWA regulates discharges to surface waters through the NPDES program, administered by the EPA. In California, the SWRCB is authorized by EPA to oversee the NPDES program through the RWQCBs (see related discussion under “Porter-Cologne Water Quality Control Act” below). The NPDES program provides for both general permits (those that cover a number of similar or related activities) and individual permits.

NPDES permits typically specify Waste Discharge Requirements (WDRs) for controlling water pollution. However, the Project discharges would not require an NPDES permit because reservoir releases do not require NPDES permits.

Agricultural and Wetland Runoff. Agricultural return flows and water from managed wetlands (i.e., water from island drains) are considered nonpoint sources. Agricultural return flows and discharges from managed wetlands are covered by the Central Valley RWQCB irrigated land regulatory waiver program. Participants in the waiver program need to monitor water quality and implement practices to meet water quality objectives.

Construction Activities. Most construction activities that disturb 1 acre of land or more are required to obtain coverage under the NPDES General Permit for Construction Activities (General Construction Permit), which requires the applicant to file a notice of intent (NOI) to discharge stormwater and to prepare and implement a SWPPP. The SWPPP includes a site map and a description of proposed construction activities, along with a demonstration of compliance with relevant local ordinances and regulations, and an overview of the BMPs that would be implemented to prevent soil erosion and discharge of other construction-related pollutants that could contaminate nearby water resources. Permittees are further required to conduct annual monitoring and reporting to ensure that BMPs are implemented correctly and effective in controlling the discharge of stormwater-related pollutants.

Dewatering Activities. While small amounts of construction-related dewatering are covered under the General Construction Permit, the Central Valley RWQCB also has adopted a General Order for Dewatering and Other Low Threat Discharges to Surface Waters (General Dewatering Permit). This permit applies to various categories of dewatering activities that would exceed the dewatering allowed by the General Construction Permit. The General Dewatering Permit contains waste discharge limitations and prohibitions similar to those in the General

Construction Permit. To obtain coverage, the applicant must submit an NOI and pollution prevention and monitoring program (PPMP). The PPMP must include a description of the discharge location, discharge characteristics, primary pollutants, receiving water, treatment systems, spill prevention plans, and other measures necessary to comply with discharge limits. A representative sampling and analysis program must be prepared as part of the PPMP and implemented by the permittee, along with recordkeeping and quarterly reporting requirements during dewatering activities. For dewatering activities that are not covered by the General Dewatering Permit, an individual NPDES permit and WDRs must be obtained.

Section 404

Section 404 of the CWA regulates the discharge of dredged and fill materials into "waters of the United States," which include oceans, bays, rivers, streams, lakes, ponds, and wetlands. Project proponents must obtain a permit from USACE for all discharges of dredged or fill material into waters of the United States, including wetlands, before proceeding with a proposed activity. Before any actions that may affect surface waters are carried out, a delineation of jurisdictional waters of the United States must be completed, following USACE protocols.

Section 404 permits may be issued only for the least environmentally damaging practicable alternative. That is, authorization of a proposed fill is prohibited if there is a practicable alternative that would have less adverse effects and lacks other significant adverse consequences.

Endangered Species Act

USFWS issued a BO on the OCAP operational effects on delta smelt on December 15, 2008, which concluded that the continued operation of the CVP and SWP will jeopardize the continued existence of delta smelt and adversely modify its critical habitat. The BO prescribed a Reasonable and Prudent Alternative (RPA) intended to protect all life stages of delta smelt and avoid adverse modification to critical habitat.

The NMFS OCAP BO released in June 2009 concluded that the CVP and SWP OCAP would jeopardize the continued existence of federally listed Endangered Sacramento River winter-run Chinook salmon, Threatened Central Valley spring-run Chinook salmon, Threatened Central Valley steelhead, Threatened southern DPS of North American green sturgeon, and Endangered southern resident killer whales. The 2009 NMFS BO contained a suite of RPA measures to avoid the likelihood of jeopardy to the species and to avoid adverse modification of designated and proposed critical habitat.

These decisions, documents, and RPAs are discussed in detail in Section 3.4, "Aquatic Resources."

Safe Drinking Water Act

The Federal Safe Drinking Water Act (SDWA) was passed in 1974 to protect drinking water quality. The EPA establishes the national standards for drinking water quality. Two amendments to the SDWA, the Stage 1 and Stage 2 Disinfectants and Disinfection By-Products Rules, establish rules to reduce health risks associated with DBPs. These two amendments are balanced by the Enhanced Surface Water Treatment Rules that were established to minimize illness resulting from microbial contamination of drinking water, which can occur with inadequate disinfection.

Standards for total organic carbon (TOC) removal before treatment have been adopted under the SDWA. TOC consists of both DOC and particulate organic carbon (POC). The SDWA rules specify requirements for the removal of TOC by drinking water providers. Municipal water treatment plants may remove this substance by enhanced coagulation (e.g., using alum); water systems that obtain their water supplies from surface-water or groundwater sources and use conventional filtration processes may use enhanced softening to remove TOC.

Table 3.11-1 shows the percentage of TOC that must be removed based on the alkalinity and TOC concentrations in source water. Removal of TOC before chlorination generally will reduce the THM concentrations. Because

Delta water generally has an alkalinity between 60 and 120 milligrams per liter (mg/l) as calcium carbonate ($CaCO_3$) with TOC concentrations between 2 mg/l and 8 mg/l, removal of 25% or 35% of the raw-water TOC would be required. This TOC would be removed before the water is chlorinated to reduce the necessary chlorine (Cl_2) dose and to reduce the subsequent formation of THMs. TOC concentrations and TOC removal is not as important for treatment plants using alternative disinfection technologies, such as ozone.

Table 3.11-1
Requirements for Percentage of Total Organic Carbon to Be Removed for Systems Using Conventional Treatment

Source Water Total Organic Carbon (mg/l)	Alkalinity		
	0–60 mg/l as $CaCO_3$	60–120 mg/l as $CaCO_3$	>120 mg/l as $CaCO_3$
2–4	35%	25%	15%
4–8	45%	35%	25%
>8	50%	40%	30%

Notes: mg/l = milligrams per liter; $CaCO_3$ = calcium carbonate; > = greater than

Source: ICF 2010:4.2-11 based on U.S. Environmental Protection Agency 2001, Stage 1 disinfectants and disinfection by-products rule; adapted by AECOM in 2013

DOC usually represents more than 90% of the TOC present in Delta waters (California Department of Water Resources 1994). For example, in a study of DOC emitted from peat inundated in tanks, DOC was found to be 93 to 98% of TOC. In an evaluation of the water on a flooded island (Jones Tract in 2004), DOC was found to be 84% of TOC (Reddy 2005:2).

The EPA maximum contaminant level (MCL) for THM concentrations in treated drinking water is 80 micrograms per liter (µg/l). Because THM concentrations vary seasonally, the THM standard is applied based on a running annual average of quarterly samples in a utilities distribution system. Many water treatment plants have responded to the TOC removal and THM regulations by using enhanced coagulation prior to disinfection or by changing the disinfection technology (e.g., ozone [O_3]). The water treatment alternatives for drinking water supplies from the Delta are reviewed in Appendix H, "Delta Drinking Water Quality and Treatment Costs," in the Public Policy Institute of California Report *Comparing Futures for the Sacramento–San Joaquin Delta* (Public Policy Institute of California 2008) (see also Chapter 2, "Project Description and Alternatives" of this SDEIS).

STATE

Porter-Cologne Water Quality Control Act

In 1967, the Porter-Cologne Act established the SWRCB and nine RWQCBs as the primary state agencies with regulatory authority over California water quality and appropriative surface water rights allocations. Under this act (and the CWA), the state is required to adopt a water quality control policy and WDRs to be implemented by the SWRCB and nine RWQCBs. The SWRCB also establishes water quality control plans (WQCPs or basin plans) and statewide plans. The RWQCBs carry out SWRCB policies and procedures throughout the state.

WQCPs, also known as basin plans, designate beneficial uses for specific surface water and groundwater resources and establish water quality objectives to protect those uses. The basin plans define surface water quality objectives for multiple parameters, including suspended material, turbidity, pH, DO, bacteria, temperature, salinity, toxicity, ammonia, and sulfides. The 2006 WQCP is the most recent WQCP for the Bay-Delta. However, no changes in water quality objectives were made from the 1995 WQCP, which was the basis for the 2001 FEIS assessment of the Delta Wetlands Project.

2006 Water Quality Control Plan and D-1641

The SWRCB implemented the 1995 WQCP with Water Right Decision 1641 (D-1641) in March 2000 (State Water Resources Control Board 1999). The most recent version of the WQCP was adopted by SWRCB in 2006. D-1641 controls the existing baseline operations assumed in CALSIM and the In-Delta Storage Model (IDSM). The two basic objectives relating to water quality (salinity and X2) are described below.

Several Delta locations have specified salinity objectives. Some of these protect aquatic habitat conditions, some protect agricultural diversions within the Delta, and some protect diversions for municipal water supply. SWP and CVP operations are required to not violate these salinity objectives. The salinity objectives at Emmaton on the Sacramento River and at Jersey Point on the San Joaquin River often control Delta outflow (i.e., require upstream reservoir releases and/or reduction in south Delta export pumping) during the irrigation season from April through August. The compliance values as well as the period of compliance change with water year type. The CALSIM model uses an internal computation to estimate the export/outflow split for a monthly inflow that would protect these salinity objectives.

The location of the estuarine salinity gradient is regulated during the months of February–June by the average position of the 2 parts per thousand [ppt] salinity isohaline (X2 objective). The X2 position must remain downstream of Collinsville (81 kilometers upstream from the Golden Gate Bridge) for the entire 5-month period in most years. This requires a minimum outflow of about 7,100 cubic feet per second (cfs). The X2 objective specifies the number of days each month when the location of X2 must be downstream of Chipps Island (now Mallard Slough, at kilometer 75) or downstream of Port Chicago (opposite Roe Island, at kilometer 64). The number of days depends on the previous month runoff index value. Maintaining X2 at Chipps Island requires a Delta outflow of about 11,400 cfs, and maintaining X2 at Port Chicago requires a Delta outflow of about 29,200 cfs. The monthly CALSIM model estimates the monthly average required outflow, obtained by averaging the outflow required for the number of days at each X2 location.

California Toxics Rule and State Implementation Policy

The California Toxics Rule was promulgated in 2000 in response to requirements of the EPA National Toxics Rule. The National Toxics Rule and California Toxics Rule criteria are regulatory criteria adopted for inland surface waters, enclosed bays, and estuaries in California that are subject to regulation pursuant to Section 303(c) of the CWA. The National Toxics Rule and California Toxics Rule include criteria for the protection of aquatic life and human health. Human health criteria (water and organisms) apply to all waters with a Municipal and Domestic Supply beneficial use designation as indicated in the RWQCBs' basin plans. The *Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California*, also known as the State Implementation Plan, was adopted by SWRCB in 2000 to establish provisions for translating California Toxics Rule criteria, National Toxics Rule criteria, and basin plan water quality objectives for toxic pollutants into the following:

- NPDES permit effluent limits,
- compliance determinations,
- monitoring for dioxin (2,3,7,8-TCDD) equivalents,
- chronic toxicity control provisions,
- initiating site-specific objective development, and
- granting exceptions.

3.11.4 ANALYSIS METHODOLOGY

HYDRODYNAMICS

Pages 3B-6 through 3B-11 of the 2001 FEIS "Hydrodynamics" chapter (incorporated herein by reference) provide details regarding the development and integration of models used for the hydrodynamics analysis for Alternatives 1 and 3.

In 2013, RMA prepared a Technical Memorandum to update the hydrodynamics modeling for Alternative 2 (the Proposed Action), which is attached as Appendix I. As described in Sections 1 and 2 therein, numerical modeling of Delta hydrodynamics was conducted using the Delta Simulation Model-2(DSM2) model HYDRO to determine the potential for the project to adversely affect the following Delta conditions: (1) scour due to increases in velocity associated with diversions and discharges of water to and from, respectively, the flooded islands associated with project activities; and (2) decreases in south Delta stage to determine if agricultural diversions or other potential uses might be affected by the project. In addition, although changes in maximum net flow conditions in channels affected by project activities may not in themselves adversely affect Delta conditions, net flow effects were analyzed to determine if the conclusions of modeling studies prepared for the 1995 DEIR/DEIS and 2001 FEIS were still valid. DSM2-HYDRO is currently considered the best available numerical modeling tool to assess the hydrodynamic conditions occurring in planning scenarios in the Delta such as the Delta Wetlands project.

Project effects were evaluated by comparing modeled hydrodynamic conditions under two scenarios: a Base Case condition and the Proposed Action. The methodology applied to evaluate project effects used a "comparative analysis" approach in which the metrics of change from Base (Project – Base) or percent change from Base were adopted. These metrics using the newest version of the DSM2-HYDRO model are similar to metrics used in the 1995 DEIR/DEIS and 2001 FEIS with the modeling tools available at that time.

Analysis of the potential for the project to negatively affect stage changes was limited to decreases stage during the discharge period when the potential exists to disrupt agricultural diversions in the south Delta. Six locations were analyzed for stage changes: the upstream and downstream sides of the three south Delta agricultural barriers modeled in DSM2 and at three additional locations in the Old and Middle River corridor. These locations extend (i.e., south Delta barriers) or reinforce (i.e., Old and Middle River) stage analyses that were documented in previous project modeling studies prepared for the 1995 DEIR/DEIS and the 2001 FEIS.

Analysis of the potential for the project to increase Base Case maximum net flow was limited to the same three locations previously used in the 1995 DEIR/DEIS and the 2001 FEIS as indicative of the overall potential for increases in maximum net flow due to project operations: (1) in Old River near Bacon Island (ROLD024), (2) in Threemile Slough near the confluence with the San Joaquin River (SLTRM004), and (3) in the lower San Joaquin River (RSAN007) near Antioch. In previous modeling work for the 1995 DEIR/DEIS and the 2001 FEIS, project effects were evaluated using the difference in maximum net flow during project operations using monthly average model results. However, project discharge and diversion periods were considered separately in the 2013 RMA analysis for the Proposed Action.

Three different models were employed in the modeling. CalSim II model outputs were used to supply boundary conditions to DSM2. Within DSM2, agricultural influences and the effect of meteorological conditions were modeled by boundary conditions supplied by the Delta Island Consumptive Use (DICU) model. These models are briefly described below.

- **CalSim** is a model that was developed by DWR to simulate SWP and CVP operations in planning studies. CalSim II is the latest version of CalSim available for general use, and it is used industry-wide as the standard model to use for simulating SWP and CVP operations. CalSim II is a planning model designed to simulate the operations of the CVP and SWP reservoirs and water delivery systems for current and future facilities, flood control operating criteria, water delivery policies, instream flow and Delta outflow requirements, and hydroelectric power generation operations. It represents the Central Valley with a node and link structure to simulate natural and managed flows in rivers and canals. It generates monthly flows showing the effect of land use, potential climate change, and water operations on flows throughout the Central Valley. The model simulates these conditions using 82 years of historical hydrology from Water Year (WY) 1922 through WY 2003.

- **DSM2** is a one-dimensional hydrodynamic and water quality simulation model used to represent conditions in the Sacramento-San Joaquin Delta. The model was developed by DWR and is frequently used to model impacts associated with projects in the Delta such as changes in exports, diversions, or channel geometries associated with dredging in Delta channels. It is frequently used in conjunction with CalSim II in planning studies to model hydrodynamics and salinity in the Delta.

- **DICU** was developed by DWR's Planning Division to estimate agricultural diversions and return flows to Delta channels. The DICU model is used in DSM2 both to estimate historical agricultural flows and to estimate project planning model agricultural volumes, and to assign these volumes and associated concentration of water quality parameters to DSM2 nodes.

Details regarding model setup and input parameters are presented on pages 3-1 through 3-14 of RMA's Technical Memorandum (SDEIS Appendix I).

WATER QUALITY

Water quality effects from project operations may occur during months for which project diversions or discharges are simulated. A new effect discussion has been added for methylmercury, and potential salinity benefits from project releases for increased Delta outflow are also described.

Project operations may cause water quality effects in the Delta by two primary mechanisms:

- Project discharges may contain concentrations of water quality constituents, such as chlorine, bromine, or DOC, that may affect water quality in Delta channels and exports.

- Project diversions or discharges may change Delta outflow or Delta channel flows, which might influence salinity intrusion or shift the contributions of water quality constituents from different Delta inflow sources. These changes may affect water quality in Delta channels and exports.

A summary of the changes in water quality analysis methodology is presented below.

1995 Draft Environmental Impact Report/Environmental Impact Statement Assessment Methods

Before the 1995 DEIR/EIS was prepared, no model existed for estimating the relationship between the water budget for Delta agricultural islands (diversions, ET, and drainage) and the salinity (EC) and DOC concentration patterns in agricultural drainage. The Delta drainage water quality model DeltaDWQ was developed to estimate the monthly contribution of the Project islands to levels of EC, DOC, chlorine, and Br- at Delta channel locations and in Delta diversions and exports under No-Project conditions and under project operations. DeltaDWQ combined monthly calculations of monthly channel flows (based on the RMA Delta hydrodynamic model) with estimates of monthly diversion, storage, and discharge volumes for the project islands (based on specified monthly project operations criteria) to simulate water quality concentrations of EC and DOC in monthly agricultural drainage flows and project discharges. Delta agricultural drainage water quality was estimated by simultaneously accounting for water, salt, and DOC budgets. Appendix C4 in the 1995 DEIR/EIS (incorporated herein by reference) provides a description of the model. DeltaDWQ results for salinity generally were found to be similar to historical data and results from the RMA Delta salinity model. Estimated agricultural drainage DOC and export DOC were similar to the measured DOC values for the 10-year calibration period of 1982–1991 (DOC data available for 1987–1991).

Water quality effects of project operations were assessed by comparing conditions under simulated project operations with conditions under the simulated baseline conditions. The simulated baseline represents Delta water quality conditions that are likely to exist in the absence of project operations (i.e., continued farming operations on the four project islands), with a repeat of the historical hydrologic conditions, but with existing facilities, water demands, and Delta standards (D-1641).

2000 Revised Draft Environmental Impact Report/Environmental Impact Statement Assessment Methods

For the 2000 RDEIR/EIS, the DeltaSOS monthly Delta water operations model was modified to incorporate the equations for predicting the water quality of agricultural drainage and Reservoir Island storage that initially had been developed for the Delta DWQ model. The revised model was used to calculate the effects of project discharges on constituent concentrations in Delta channels and exports. This modification of DeltaSOS to include water quality calculations was called the DeltaSOQ model. The Q model calculations generally were confirmed by comparing historical water quality measurements of Delta inflows, agricultural drainage, and exports. The calculated monthly EC and DOC at the exports, based on the measured inflow concentrations and calculated agricultural drainage concentrations, were similar to the measured EC and DOC values for the 1972–1994 period (DOC data available for 1987–1994).

The full 1922–1994 Delta water operations period was used in the 2000 RDEIR/EIS assessment of water quality changes. The results from the most recent 23-year period of the hydrologic record (1972–1994) were shown graphically to illustrate the model calculations and results. The assumptions used for these assessment methods were described in Appendix G of the 2000 RDEIR/EIS and are incorporated herein by reference.

Four locations in the Delta (Chipps Island, Emmaton, Jersey Point, and Rock Slough intake) were selected for assessment of effects related to Delta salinity conditions. CCWD's Rock Slough intake was used as representative of Delta exports (CVP exports at Tracy, SWP exports at Banks, and CCWD diversions at Rock Slough, Old River, and Victoria Canal) for several reasons, but primarily because of its critical location and importance for monitoring Delta salinity. First, the salinity at Rock Slough generally would be higher than the salinity at the SWP and CVP export pumps and CCWD's other major diversion at Old River and Victoria Canal. Second, the Proposed Action's proposed operations would have a larger effect on the Rock Slough intake than it would at other, more distant export and diversion facilities. Lastly, DWR initiated a water quality monitoring program in August 2001 in accordance with the provisions of the SWRCB Water Right Decision (D-1641), in which SWP and CVP are responsible for maintaining the water quality objectives for municipal and industrial beneficial uses within the Delta. D-1641 identified CCWD's pumping plant #1 at the Rock Slough intake as the key compliance station responsible for meeting the water quality objectives set by SWRCB that require maximum mean daily chloride levels to be below 150 mg/L for a set number of days based on water year type (State Water Resources Control Board Water Quality Control Plan 2006). To further identify other sources and the extent of water quality degradation, specifically salt loading within Rock Slough, DWR also established a water quality monitoring program within Rock Slough. TWA-12he monitoring efforts support maintaining SWP operational flexibility and prepare for future SWRCB review of Delta water quality standards. Consequently, the term "Delta export facilities" throughout this section below refers to CCWD's Rock Slough intake location, which is representative of all CVP, SWP, and CCWD export and diversion locations.

DOC effects were evaluated at the representative export location. The DOC effects are dependent on the assumed DOC loading rate from the inundated project peat-soil islands. Export DOC concentrations were evaluated with the DeltaSOQ model for a range of estimates of DOC loading from the Reservoir Islands. The initial filling of the islands likely would result in high DOC loading from the initial source of DOC in the oxidized peat soil. But in the long term, repeated fillings of the Reservoir Islands likely would leach out most of the DOC from the peat soils, and fresh DOC formation from the inundated peat soils would likely be lower than for agricultural uses. The analysis presented three simulations of potential project effects on DOC in Delta exports: an assumption for long-term DOC loading (1 g/m2/month of storage), an assumption for initial-filling DOC loading (4 g/m2/month of storage), and an assumption for high initial-filling DOC loading (9 g/m2/month of storage).

2010 Draft Environmental Impact Report

The methods used in the 2010 DEIR were also used for this SEIS, and are presented below.

Adjustments to Assessment Methods for this Supplemental Environmental Impact Statement

The general assessment methods for this SEIS are similar to those used in the 2001 FEIS. Simulated operations for the proposed action (Alternative 2 with FOC, WQMP, and other environmental commitments incorporated) are similar but more restrictive than those proposed for Alternatives 1 and 2 in the 2001 FEIS. As a result, water quality effects of the project are expected to be similar to or less than those described in the 2001 FEIS for Alternatives 1 and 2. Simulated use of some project storage water for releases to increase Delta outflow in the fall months of some years would provide salinity benefits.

This SEIS does not calculate these expected DBP concentrations, as was done for the 2001 FEIS. This SEIS uses DOC and EC to track the effects of project operations on drinking water quality. These raw water quality parameters can be used by individual treatment plant operators to estimate DBP concentrations, based on their treatment processes and applicable drinking water regulations. The WQMP restrictions on DOC and EC should be adequate to protect against elevated DBPs at the water treatment plants. However, should treatment plant operators have concerns about DBPs, the WQMP would enable them to restrict project releases.

This SEIS includes a new assessment of potential methylmercury effects. Methylmercury was evaluated quantitatively using information provided in analyses and proposed regulations from the Central Valley RWQCB.

Simulated Project Operations

The 2000 RDEIR/EIS included the FOC provisions for limiting project diversions and discharges for export to protect ESA-listed and CESA-listed fish. This reduced or eliminated some of the salinity effects that were simulated in the 1995 DEIR/EIS evaluation. Additional restrictions to protect the water quality of Delta exports and diversions of municipal water supplies were required in the WQMP. The provisions of the WQMP were included qualitatively in the 2001 FEIS, but the effects of these required monitoring and modeling comparisons, and potential project discharge restrictions were not included in the project operations modeling. The major provisions in the FOC and WQMP are summarized here to describe the linkage between these fish and water quality protection measures and the revised operations of the proposed action evaluated in this SEIS.

The project water right decision D-1643 includes several restrictions on the monthly project diversions and discharges for export pumping. These provisions, called FOC, were developed in 1997 during consultation with USFWS, NMFS, and DFW for the project’s BOs. A combined limit of 250 taf per water year was placed on project diversion to storage and direct diversion. The combined diversion limit eliminated the occasional filling, discharging, and refilling potential that was simulated in the 1995 DEIR/EIS evaluation. Most of the FOC restrictions were included in the 2000 RDEIR/EIS modeling. This SEIS simulates project diversions in the December–March period and project discharges for export in the July–September period. These generalized monthly project operations eliminate the need for several monthly FOC restrictions and provide a more realistic representation of typical project operations.

Most of the FOC diversion restrictions are satisfied with a December–March diversion period with a minimum Delta outflow of 11,400 cfs. The IDSM model used to simulate project operations include monthly criteria that match these FOC measures. However, the measures related to the FMWT index for delta smelt abundance cannot be simulated and are therefore not included in IDSM. Most of the FOC discharge restrictions are satisfied with the July–November water discharge period. The FOC also includes monitoring and discharge adjustment requirements for temperature and DO. While these requirements cannot be modeled in IDSM, compliance with these provisions in real-time daily operations are assumed to prevent any significant effects from these variables that may have effects on fish habitat conditions.

Dissolved Organic Carbon

The increased DOC from project discharges can be estimated from the project storage DOC and the baseline DOC at the export or diversion intake, together with the fraction of the water from the project discharge. The most conservative assumption is that all project discharge will be mixed with the baseline export flow and the increased DOC from project discharges would be:

- DOC increase (mg/l) = [DW DOC – Export DOC] x project discharge / [Exports + project discharge]

For the maximum assumed monthly project discharge of 2,000 cfs at the maximum permitted combined CVP and SWP pumping of 11,280 cfs, the fraction of project discharge water in the exports would be about 20% (i.e., 2,000/11,280). The DOC increase at the exports would be 20% of the difference between the storage DOC and the baseline DOC. The WQMP operations criteria of 1 mg/l would be exceeded (and would require short-term effect assessment by treatment plant operators) if the project storage DOC was more than 5 mg/l higher than the baseline export DOC. If the storage DOC was 10 mg/l higher than the baseline TOC, the WQMP operations criteria might limit project discharges to less than 10% of the exports, unless the short-term DOC increase was determined by the treatment plant operators to be acceptable for the existing treatment conditions.

SIGNIFICANCE CRITERIA

The basis for determining the significance of effects for this analysis is based on professional standards, project-specific criteria developed by the lead agency to address potential effects unique to the project's location and elements, and is informed by the criteria contained in the Environmental Checklist in Appendix G of the State CEQA Guidelines. These thresholds encompass the factors taken into account under NEPA to determine the significance of an action in terms of its context and the intensity of its effects. The Proposed Action or alternatives under consideration would have a significant, adverse hydraulic effect if they would do any of the following as specified in the 2001 FEIS:

- cause an increase in local Delta channel flows above the historical range, cause channel velocities to exceed the scouring velocity threshold of approximately 3 fps, or cause local stages to be substantially reduced from historical stages; or
- cause monthly average net channel flows to increase substantially above the historical net channel flows.

The Proposed Action or alternatives under consideration would have a significant, adverse effect on water quality if they would do any of the following:

- result in substantial increases in erosion or sedimentation;
- violate water quality standards or waste discharge requirements; or
- substantially degrade water quality.

For the effect related to substantial degradation of water quality, more specific criteria were used. The criteria used to determine the significance of effects on water quality are mostly unchanged from the 2001 FEIS and are described below. For Delta water quality variables for which no regulatory objectives or numerical standards have been set, the selected significance threshold was a percentage change from existing measured monthly values that encompasses natural variability in water quality constituents.

Significance thresholds for variables with numerical water quality criteria were established at 90% of the specified monthly water quality standards. If simulated project operations caused the value for a water quality variable to exceed 90% of the numerical standard for that variable, the effect is considered to be a significant water quality effect. Maximum significance criteria were not set for constituents that do not have numerical regulatory standards.

A second water quality significance criterion was based on the assumption that some changes may be substantial compared with the natural variability of the water quality variable under existing conditions. Natural variability was assumed to be at least 10% of the specified numerical limit or 10% of the mean value for variables without numerical limits. Measurement errors and modeling uncertainties likewise were assumed to be at least 10% of the measured or modeled values. These two sources of variability were assumed to establish a monthly significance criterion for any change caused by project operations that was more than 20% of the established standard or more than 20% of the mean value for variables without numerical limits. These significance criteria were applied to the monthly sequence of simulated project operations determined with the IDSM model.

In some cases, the water quality criteria of the WQMP are slightly less restrictive than the thresholds of significance used in the 2001 FEIS. However, because the WQMP would control project operations, the required WQMP criteria are used as thresholds of significance. For example, in the 2001 FEIS, a change in DOC of more than 0.8 mg/L at the intakes was considered significant (20% of average baseline DOC concentration), whereas in the WQMP, an increase of more than 1.0 mg/L TOC at the urban intakes could trigger potential restrictive action by the water users and is therefore considered significant.

THM and THM formation potential were evaluated as an effect in the 2001 FEIS. However, the THM concern for this project is its formation as a water treatment plant DBP. The formation of THM is dependent on the concentration of DOC and the processes used at water treatment plants. Because control of DOC would also control the formation of THM, THM is not evaluated separately in this SEIS.

3.11.5 Environmental Consequences and Mitigation Measures

Effects Analysis

Effects on hydrology and water quality resulting from project implementation were described in the 2001 FEIS (Chapters 3B and 3C) and are listed below in Table 3.11-7. Where there have been no changes to the effects analysis or conclusions, the 2001 FEIS is incorporated by reference, and the effects conclusions and mitigation measures are briefly summarized

No-Action Alternative

EFFECT WQ-1 Hydrodynamics Effects. *The proposed water diversions from and releases to Delta channels would not occur. Hydrodynamics effects under continued and intensified agricultural operations would not be substantially different from existing conditions. Thus, this effect is less than significant.*

The proposed water facilities would not be built and, therefore, project-related diversions from and releases into Delta channels would not occur. The intensified agricultural activities that would occur under the No-Action Alternative would not be substantially different from existing conditions in terms of hydrodynamics (ICF 2001: Chapter 3B and Resource Management Associates 2013). Thus, this effect is **less than significant**.

EFFECT WQ-2 Salinity Increase. *Agricultural operations would continue to use irrigation water, and the existing gradual buildup of salt in agricultural soils would continue. Water drained from islands with continued agriculture would have increasingly higher salinities over time but would not be substantially different from existing conditions. This effect is less than significant.*

The existing water quality for the Delta includes a range of seasonal and year-to-year variations in water quality as predicted with Delta inflows and D-1641 objectives. Delta salinity and export water quality without the project (i.e., continued agricultural uses on the four project islands) would be similar to those observed in recent years (since 1995 when WQCP objectives were implemented). There would be no measurable changes in water quality compared to existing conditions. Salinity (measured as EC), is one of the three main water quality constituents in agricultural drainwater that have been measured and are a concern for water quality in the Delta.

As described in the 2001 FEIS, measurements of drainage EC from many of the Delta island agricultural drains show a strong seasonal pattern, with the highest EC values in drainage water during winter. EC values generally ranged from low values characteristic of Delta channel water (137 to 568 µS/cm) to much higher values (1,280 to 2,870 µS/cm). This range in drainage EC values is expected because of the variation in Delta precipitation and irrigation, leaching, and drainage practices. Higher EC values indicate that the salt has become concentrated in the agricultural soils through ET.

The salt in irrigation water becomes concentrated on Delta islands as a result of evaporation. The islands do not provide any additional salts beyond what originates from irrigation water. Water drained from islands with continued and intensified agriculture would have increasingly higher salinities over time but would not be substantially different from existing conditions. This effect is **less than significant**.

EFFECT WQ-3 Elevated DOC Concentrations. *Agricultural drainage water from the project islands has higher concentrations of DOC as compared to irrigation water that is applied to the islands. Water drained from the islands with continued and intensified agriculture would potentially have increasingly higher DOC concentrations over time but would not be substantially different from existing conditions. This effect is less than significant.*

DOC is one of the three main water quality constituents in agricultural drainwater that have been measured and are a concern for water quality in the Delta. As described in the 2001 FEIS, Delta islands are a source of DOC (i.e., total DOC leaving the islands is greater than DOC applied to the islands). Appendix G, "Water Quality Assessment Methods," of the 2000 RDEIR/EIS (incorporated herein by reference) presents detailed information on agricultural drainage water quality for Bacon Island, Webb Tract, Bouldin Island, Holland Tract, and Twitchell Island. Based on these estimates and on model calibration results, an average of 12 g-C/m2/yr was used in the 2001 FEIS for the DOC loading estimate for existing agricultural drains in the Delta. Water drained from the islands with continued and intensified agriculture would potentially have increasingly higher DOC concentrations over time but would not be substantially different from existing conditions. This effect is **less than significant**.

EFFECT WQ-4 Increased Methylmercury Loading. *Continued and intensified agricultural activities would result in continued and potentially somewhat higher methylmercury production, but loading would not be substantially different from existing conditions. This effect is less than significant.*

Methylmercury is one of the three main water quality constituents in agricultural drainwater that has been measured and is a concern for water quality in the Delta. Methylmercury is produced and exported from Delta agricultural lands. Methylmercury loads from Delta agricultural lands with high organic content have been estimated at between 0.3 and 4.5 ng/m2/day (Heim et al. 2009:33; Wood et al. 2010a:108). Water drained from the islands with continued and intensified agriculture would potentially have increasingly higher methylmercury loading over time but would not be substantially different from existing conditions. This effect is **less than significant**.

EFFECT WQ-5 Increase in Pollutant Loading in Delta Channels Associated with Recreational Boating. *The No-Action Alternative would not entail the construction of new recreational facilities. This effect is less than significant.*

Under the No-Action Alternative, no new recreation facilities would be constructed, and the small increase in recreational use of the project islands that may occur over time would not result in a substantial increase in contamination of Delta water from recreational boating. This effect is **less than significant**.

Alternative 1 and Alternative 2 (Proposed Action)

The amount of water diverted onto and released from the two Reservoir Islands could be slightly less under Alternative 1 from the amount under Alternative 2. However, the difference would be too small to alter the level of significance of each of the effects on hydrology and water quality. Since the analysis and mitigation measures for Alternatives 1 and 2 are substantially similar, they are described together under this heading.

EFFECT WQ-1 **Hydrodynamic Effects on Local Channel Velocities and Stages From Project Diversions and Discharges**. *Modeling results indicate that project effects on local channel velocities and stages would be small and within the range of conditions normally encountered in the Delta. This effect is less than significant.*

The hydrodynamic simulation results for the maximum possible initial daily average diversion and discharge rates under Alternative 1 (ICF 2001: 3B-17 through 3B-19) indicated that maximum possible channel velocities and stages are within the range of conditions normally encountered during tidal fluctuations in the Delta channels surrounding the project islands.

The results of the RMA (2013:4-17 through 4-19) update to the Alternative 2 velocity and stage analysis using DSM2 indicate the effect of the Delta Wetlands project on scour due to increases in velocity in the Delta and on disruptions to agricultural activities due to decreases in stage in the south Delta are less than 5% as evaluated using monthly average model results. The velocity changes due to the project that increased velocity magnitude were less than 2.9% on a daily basis, and they occurred at one location on only a few days during the periods of diversion and/or discharge. At each of the six locations analyzed for stage changes, the percent change from the Base Case on a monthly average basis under Alternative 2 was less than 1.6%.

Therefore, for the reasons stated above, this effect is **less than significant**.

Mitigation Measure: No mitigation is required.

EFFECT WQ-2 **Hydrodynamic Effects on Net Channel Flows**. *Modeling results indicate that project effects on net channel flows would be small and within the range of conditions normally encountered in the Delta. This effect is less than significant.*

The analysis of the project's potential to increase the maximum net flow was conducted in the following three locations: in Old River near Bacon Island (ROLD024), in Threemile Slough near the confluence with the San Joaquin River (SLTRM004), and in the lower San Joaquin River (RSAN007) near Antioch.

The hydrodynamic simulation results for net channel flows under Alternative 1 (ICF 2001: 3B-19 through 3B-20) indicated that all simulated changes are well within the historical range of Delta channel flows at the locations selected for assessment.

The results of the RMA (2013:4-19 and 4-20) update to the Alternative 2 effects on net channel flows indicate that in one diversion period in Threemile Slough, the monthly average net flow during project operations exceeded the Base Case (i.e., without project) flow by 5.6%. However, in this instance, high inflow conditions on the Sacramento, San Joaquin, and other tributary rivers prompted both high state and Federal exports from the south Delta and maximum Project diversions, contributing to the high net flows at SLTRM004. Otherwise, the project did not cause an increase in net channel flows beyond the Base Case (i.e., without project) conditions.

Therefore, project operations would not result in adverse effects on net channel flows in the Delta, and this effect is **less than significant**.

Mitigation Measure: No mitigation is required.

EFFECT WQ-3 Salinity Increase at Chipps Island. *Because the simulated project operations for this SEIS require a minimum outflow of about 11,400 cfs (i.e., X2 downstream of Chipps Island) during diversions, the simulated EC changes at Chipps Island demonstrate that the project would meet the WQMP criteria. This effect is less than significant.*

Exhibit 3.11-6a shows the historical Delta outflow for water years 1976–1991 with the effective Delta outflow calculated using the CCWD G-model equation (see Appendix G of 2000 RDEIR/EIS, incorporated herein by reference). The effective outflow is very similar to a 3-month moving average outflow, although the effective outflow changes more rapidly and is closer to the measured outflow when the outflow is high, and changes more slowly when the outflow is low. The effective outflow is generally higher than the lowest monthly outflow values. Exhibit 3.11-6b shows the measured Chipps Island EC for 1976–1991. The effective Delta outflow largely controls the measured EC patterns in the Delta. The estimated Chipps Island EC using the negative exponential relationship between effective Delta outflow and monthly average EC at Chipps Island for the 1976–1991 period is shown in comparison.

Exhibit 3.11-7a shows the strong negative exponential relationship between effective Delta outflow and Chipps Island EC. The estimated EC at Chipps Island is about 5,000 µS/cm when the Delta outflow is about 4,500 cfs. The estimated EC at Chipps Island is about 2,000 µS/cm when the effective outflow is about 11,000 cfs. This relationship was included in the IDSM model so that the Chipps Island EC for the baseline and project conditions could be evaluated. The change in the EC caused by project diversions is much less at high outflows than at low outflows.

Table 3.11-2 part A gives the monthly cumulative distributions of simulated EC at Chipps Island for the baseline conditions. Table 3.11-2 part B gives the monthly cumulative distributions of simulated EC at Chipps Island with project operations (diversions and releases for outflow). Table 3.11-2 part C gives the monthly cumulative distributions of simulated changes in EC at Chipps Island with project operations. The modeling data indicate that the maximum increases in Chipps Island EC were always less than the 20% significance criteria. Project operations never cause the Chipps Island EC to exceed 90% of the D-1641 objectives, which would be 2,640 µS/cm in months when X2 was required to be downstream of Chipps Island (February and March of some years).

It should also be noted that the WQMP criteria for salinity are more stringent than the thresholds of significance. The simulated project operations for this SEIS require a minimum outflow of about 11,400 cfs (i.e., X2 downstream of Chipps Island) during diversions. The EC changes at several Delta locations would be tracked as part of the required WQMP monitoring program. Both the short-term (monthly) and long-term (annual) changes would be calculated and tracked as part of the WQMP. Adherence to the WQMP requirements has been incorporated into the project as an environmental commitment. Therefore, project compliance with the WQMP would ensure that salinity effects are **less than significant**.

Mitigation Measure: No mitigation is required.

EFFECT WQ-4 Salinity Increase at Emmaton. *Because the simulated project operations for this SEIS require a minimum outflow of about 11,400 cfs during diversions, the simulated EC changes at Emmaton demonstrate that the project would meet the WQMP requirements. Diversions would only occur in the months of December-March when there are no established salinity objectives at Emmaton. This effect is less than significant.*

Exhibit 3.11-7b shows the relationship between effective Delta outflow and monthly average measured EC at Emmaton for the 1976–1991 period. There is a strong negative exponential relationship that can be estimatedfrom the historical Delta outflow and EC data. The Emmaton EC is less than 2,000 µS/cm when the outflow is greater than 5,000 cfs. The Emmaton EC is less than 250 µS/cm when the outflow is 12,000 cfs. This relationship was included in the IDSM model so that the Emmaton EC for the baseline and project conditions could be evaluated.

Table 3.11-2
Monthly Cumulative Distributions for IDSM Simulated EC at Chipps Island for 1922–2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
A. Simulated EC at Chipps Island with Baseline Delta Conditions												
Min	537	150	150	150	150	150	150	150	150	152	305	298
10%	3,746	1,991	150	150	150	150	150	150	162	913	4,090	4,415
20%	6,860	5,539	248	150	150	150	151	168	533	1,785	4,642	6,702
30%	9,292	6,900	1,206	151	150	151	166	220	1,054	2,153	4,991	8,175
40%	9,784	9,071	4,291	306	151	159	252	472	1,590	2,692	5,244	8,424
50%	10,311	9,629	6,832	1,355	166	170	379	910	2,054	3,302	5,562	8,867
60%	10,702	10,174	8,123	2,644	361	373	644	1,453	2,803	3,654	6,466	9,129
70%	11,014	10,571	8,853	5,137	991	543	945	2,245	3,642	5,196	7,114	9,615
80%	11,219	10,798	9,534	7,207	1,867	1,229	1,598	2,721	4,206	5,476	7,633	10,272
90%	11,943	11,521	9,955	7,993	3,882	2,611	3,037	4,029	5,532	7,225	9,215	10,698
Max	12,365	12,452	11,182	10,130	8,477	6,728	6,083	7,299	8,962	9,478	10,047	11,624
Avg	9,131	8,264	5,502	3,035	1,202	792	994	1,617	2,629	3,740	5,992	8,180
B. Simulated EC at Chipps Island with Project Operations												
Min	537	150	150	150	150	150	150	150	150	152	305	298
10%	3,746	1,542	150	150	150	150	150	150	162	913	4,090	4,415
20%	6,860	4,285	322	150	150	150	151	168	533	1,785	4,642	6,702
30%	8,596	5,583	1,475	152	150	151	166	220	1,054	2,153	4,991	8,140
40%	9,059	7,102	4,234	449	151	160	252	472	1,590	2,692	5,244	8,298
50%	9,998	8,883	5,514	1,656	169	180	380	910	2,054	3,302	5,562	8,725
60%	10,621	9,916	7,084	2,588	416	387	649	1,453	2,805	3,655	6,466	9,125
70%	11,005	10,468	8,278	4,970	1,239	579	987	2,254	3,642	5,197	7,114	9,615
80%	11,211	10,737	9,205	6,875	1,867	1,228	1,615	2,749	4,215	5,479	7,633	10,272
90%	11,943	11,521	9,955	7,844	3,754	2,580	3,037	4,030	5,534	7,226	9,215	10,698
Max	12,365	12,452	11,182	10,130	8,477	6,728	6,083	7,299	8,962	9,478	10,047	11,623
Avg	8,933	7,666	5,192	3,019	1,225	805	1,002	1,619	2,630	3,740	5,992	8,152
C. Simulated Changes in EC at Chipps Island with Project Operations												
Min	-1,568	-2,556	-2,290	-923	-235	-41	-10	-4	-2	-1	0	-677
10%	-704	-1,882	-1,651	-285	-4	0	0	0	0	0	0	0
20%	-619	-1,531	-613	-15	0	0	0	0	0	0	0	0
30%	-73	-738	-62	0	0	0	0	0	0	0	0	0
40%	0	-369	0	0	0	0	0	0	0	0	0	0
50%	0	-91	0	0	0	0	0	0	0	0	0	0
60%	0	0	0	0	0	0	0	0	0	0	0	0
70%	0	0	0	0	0	0	0	0	0	0	0	0
80%	0	0	0	1	4	10	1	0	0	0	0	0
90%	0	0	39	224	74	66	20	6	2	1	0	0
Max	0	0	582	822	542	189	169	41	12	4	1	1
Avg	-198	-598	-310	-17	23	13	8	2	1	0	0	-28

Notes: EC = electrical conductivity

Source: ICF 2010:4.2-53; adapted by AECOM in 2013

There are essentially no salinity intrusion effects at Emmaton for outflow greater than 10,000 cfs. Therefore, the monthly salinity change at Emmaton caused by project diversions (i.e., outflow reduction) will never be greater than 20% of the average Emmaton EC. Table 3.11-3 part A gives the monthly cumulative distributions of simulated EC at Emmaton for the baseline conditions. Table 3.11-3 part B gives the monthly cumulative distributions of simulated EC at Emmaton with project operations. Table 3.11-3 part C gives the monthly cumulative distributions of simulated changes in EC at Emmaton with project operations. The maximum monthly increases in Emmaton EC caused by project operations (i.e., diversions) were always much less than 20% of the average baseline EC, calculated to be 747 µS/cm in the IDSM model for 1922–2003. Therefore, this effect is **less than significant**.

Mitigation Measure: No mitigation is required.

EFFECT WQ-5 **Salinity Increase at Jersey Point.** *Because the simulated project operations for this SEIS require a minimum outflow of about 11,400 cfs during diversions, the simulated EC changes at Jersey Point demonstrate that the project would meet the WQMP requirements. Diversions would occur only in the months of December–March when there are no established salinity objectives at Jersey Point. This effect is less than significant.*

Exhibit 3.11-7c shows the relationship between effective Delta outflow and monthly average measured EC at Jersey Point for the 1976–1991 period. There is a strong negative exponential relationship that can be estimated from the historical Delta outflow and EC data. The Jersey Point EC is about 2,000 µS/cm when the outflow is 4,000 cfs and the Jersey Point EC is about 1,000 µS/cm when the outflow is 6,000 cfs. This relationship was included in the IDSM model so that the Jersey Point EC for the baseline and project conditions could be evaluated.

There are essentially no salinity intrusion effects at Jersey Point for outflow greater than 10,000 cfs. Therefore, the monthly salinity change at Jersey Point caused by project diversions (i.e., outflow reduction) will never be greater than 20% of the average Jersey Point EC. Table 3.11-4 part A gives the monthly cumulative distributions of simulated EC at Jersey Point for the baseline conditions. Table 3.11-4 part B gives the monthly cumulative distributions of simulated EC at Jersey Point with project operations. Table 3.11-4 part C gives the monthly cumulative distributions of simulated changes in EC at Jersey Point with project operations. The maximum monthly increases in Jersey Point EC from project operations (i.e., diversions) were always much less than 20% of the average baseline EC, calculated to be 628 µS/cm in the IDSM model for 1922–2003. Therefore, this effect is **less than significant**.

Mitigation Measure: No mitigation is required.

Exhibit 3.11-7d shows the relationship between effective Delta outflow and monthly average measured chloride and EC at the CCWD Rock Slough intake. The Rock Slough EC is generally about half of the Jersey Point EC because it is farther upstream in the Delta. The Rock Slough EC is about 1,000 µS/cm when the outflow is 4,000 cfs and about 500 µS/cm when the outflow is 6,000 cfs. The chloride is about 25% of the EC at high EC values, because the highest EC values are influenced by seawater intrusion. The chloride is a smaller fraction of the EC at lower EC values because the river chloride content (i.e., Cl/EC ratio) is lower.

EFFECT WQ-6 **Salinity Increase at Delta Export Facilities.** *Because the simulated project operations for this SEIS require a minimum outflow of about 11,400 cfs during diversions, the simulated chloride changes at Delta export facilities demonstrate that the project would meet the WQMP requirements. Diversions would occur only in the months of December–March when the minimum chloride objective would be 150 mg/l. This effect is less than significant.*

Table 3.11-3
Monthly Cumulative Distributions for IDSM-Simulated EC at Emmaton

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
A. Simulated EC at Emmaton with Baseline Delta Conditions												
Min	159	150	150	150	150	150	150	150	150	150	152	152
10%	486	266	150	150	150	150	150	150	150	179	538	591
20%	1,061	791	151	150	150	150	150	150	159	245	629	1,027
30%	1,644	1,070	200	150	150	150	150	151	187	282	690	1,363
40%	1,774	1,586	571	152	150	150	151	157	228	343	736	1,423
50%	1,919	1,733	1,055	208	150	150	154	178	271	422	796	1,534
60%	2,029	1,881	1,350	338	154	154	164	216	356	472	977	1,601
70%	2,119	1,992	1,531	717	183	160	180	291	470	727	1,116	1,729
80%	2,178	2,057	1,708	1,137	253	199	228	346	557	779	1,234	1,908
90%	2,395	2,268	1,821	1,319	506	333	387	529	790	1,141	1,624	2,028
Max	2,525	2,552	2,168	1,869	1,437	1,032	898	1,158	1,558	1,693	1,846	2,298
Avg	1,693	1,503	970	534	258	201	214	282	406	554	923	1,432
B. Simulated EC at Emmaton with Project Operations												
Min	159	150	150	150	150	150	150	150	150	150	152	152
10%	486	227	150	150	150	150	150	150	150	179	538	591
20%	1,061	570	153	150	150	150	150	150	159	245	629	1,027
30%	1,466	800	218	150	150	150	150	151	187	282	690	1,354
40%	1,583	1,114	562	157	150	150	151	157	228	343	736	1,393
50%	1,832	1,538	787	233	150	150	154	178	271	422	796	1,498
60%	2,006	1,810	1,110	332	155	154	164	216	357	472	977	1,600
70%	2,116	1,963	1,388	687	200	161	183	292	470	727	1,116	1,729
80%	2,176	2,039	1,621	1,064	253	199	230	350	558	780	1,234	1,908
90%	2,395	2,268	1,821	1,284	487	329	387	529	790	1,141	1,624	2,028
Max	2,525	2,552	2,168	1,869	1,437	1,032	898	1,158	1,558	1,693	1,846	2,298
Avg	1,640	1,373	899	523	258	201	214	282	406	554	923	1,425
C. Simulated Changes in EC at Emmaton with Project Operations												
Min	-415	-630	-568	-214	-43	-5	-2	-1	0	0	0	-170
10%	-183	-384	-315	-43	0	0	0	0	0	0	0	0
20%	-165	-308	-126	-2	0	0	0	0	0	0	0	0
30%	-19	-178	-12	0	0	0	0	0	0	0	0	0
40%	0	-51	0	0	0	0	0	0	0	0	0	0
50%	0	-8	0	0	0	0	0	0	0	0	0	0
60%	0	0	0	0	0	0	0	0	0	0	0	0
70%	0	0	0	0	0	0	0	0	0	0	0	0
80%	0	0	0	0	0	0	0	0	0	0	0	0
90%	0	0	1	11	2	2	1	1	0	0	0	0
Max	0	0	42	104	34	10	11	5	2	1	0	0
Avg	-52	-130	-71	-10	0	0	0	0	0	0	0	-7

Notes: EC = electrical conductivity

Source: ICF 2010:4.2-54; adapted by AECOM in 2013

Table 3.11-4
Monthly Cumulative Distributions for IDSM-Simulated EC at Jersey Point

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
A. Simulated EC at Jersey Point with Baseline Delta Conditions												
Min	158	150	150	150	150	150	150	150	150	150	152	152
10%	419	243	150	150	150	150	150	150	150	173	461	503
20%	879	663	151	150	150	150	150	150	157	226	533	851
30%	1,345	886	190	150	150	150	150	150	180	255	582	1,120
40%	1,449	1,299	487	152	150	150	151	156	212	304	619	1,169
50%	1,565	1,416	874	197	150	150	153	172	247	368	667	1,257
60%	1,653	1,535	1,110	300	153	153	161	203	315	408	811	1,311
70%	1,725	1,623	1,255	603	176	158	174	263	406	612	923	1,413
80%	1,773	1,675	1,396	940	232	189	213	307	476	653	1,017	1,556
90%	1,946	1,844	1,487	1,085	435	296	339	453	662	943	1,329	1,652
Max	2,050	2,072	1,764	1,525	1,179	856	748	956	1,277	1,384	1,507	1,869
Avg	1,384	1,233	806	457	236	191	201	256	354	473	768	1,176
B. Simulated EC at Jersey Point with Project Operations												
Min	158	150	150	150	150	150	150	150	150	150	152	152
10%	419	211	150	150	150	150	150	150	150	173	461	503
20%	879	486	152	150	150	150	150	150	157	226	533	851
30%	1,203	670	204	150	150	150	150	150	180	255	582	1,113
40%	1,297	921	479	155	150	150	151	156	212	304	619	1,144
50%	1,496	1,261	659	217	150	150	153	172	247	368	667	1,229
60%	1,635	1,478	918	296	154	153	161	203	315	408	811	1,310
70%	1,723	1,600	1,140	580	190	159	176	264	406	612	923	1,413
80%	1,771	1,661	1,327	881	232	189	214	310	477	654	1,017	1,556
90%	1,946	1,844	1,487	1,057	420	293	339	453	662	943	1,329	1,652
Max	2,050	2,072	1,764	1,525	1,179	856	748	956	1,277	1,384	1,507	1,869
Avg	1,342	1,129	749	449	237	191	202	256	354	473	768	1,170
C. Simulated Changes in EC at Jersey Point with Project Operations												
Min	-332	-504	-454	-171	-34	-4	-1	-1	0	0	0	-136
10%	-146	-307	-252	-34	0	0	0	0	0	0	0	0
20%	-132	-247	-100	-2	0	0	0	0	0	0	0	0
30%	-15	-142	-9	0	0	0	0	0	0	0	0	0
40%	0	-41	0	0	0	0	0	0	0	0	0	0
50%	0	-6	0	0	0	0	0	0	0	0	0	0
60%	0	0	0	0	0	0	0	0	0	0	0	0
70%	0	0	0	0	0	0	0	0	0	0	0	0
80%	0	0	0	0	0	0	0	0	0	0	0	0
90%	0	0	1	9	2	2	1	1	0	0	0	0
Max	0	0	34	83	28	8	9	4	1	1	0	0
Avg	-42	-104	-57	-8	0	0	0	0	0	0	0	-6

Notes: EC = electrical conductivity

Source: ICF 2010:4.2-55; adapted by AECOM in 2013

The salinity at Rock Slough generally would be higher than the salinity at the Old River intake or at the SWP and CVP export pumps. The Rock Slough intake would have a larger effect from project operations than the other drinking water intakes. There is a much weaker relationship that can be estimated from the historical Delta outflow and salinity (i.e., EC and chloride data). This relationship was included in the IDSM model so that the Rock Slough EC and chloride for the baseline and project conditions could be evaluated.

There are essentially no salinity intrusion effects at Rock Slough for outflow greater than 10,000 cfs. Therefore, the monthly salinity changes at Rock Slough caused by project diversions (i.e., outflow reduction) would never be greater than 20% of the minimum chloride objective of 150 mg/l. The WQMP further requires that project effects be less than 10 mg/l, unless compensated for by project benefits. Table 3.11-5 part A gives the monthly cumulative distributions of simulated chloride concentration at the Rock Slough intake for baseline conditions. Table 3.11-5 part B gives the monthly cumulative distributions of simulated chloride at the Rock Slough intake with project operations. Table 3.11-5 part C gives the monthly cumulative distributions of simulated changes in chloride at the Rock Slough intake with project operations. The maximum monthly increases in Rock Slough chloride caused by project operations (i.e., diversions) would always be less than 20% of the chloride objective (30 mg/l). Adherence to the WQMP requirements has been incorporated into the project as an environmental commitment. For the reasons stated above, this effect is **less than significant**.

Mitigation Measure: No mitigation is required.

EFFECT WQ-7 **Beneficial Salinity Reductions at Delta Export Facilities.** *Because the simulated project operations for this SEIS simulate the release of project storage water in October and November in years when the water could not be exported for delivery to designated places of use or to the groundwater banks, there are substantial increases in Delta outflow that would reduce salinities at export facilities. This effect is beneficial.*

Table 3.11-5 part C indicates that the monthly chloride concentrations at Rock Slough were frequently (i.e., in about 20% of the years) reduced by more than 10 mg/l in October and November. Salinity benefits often were simulated in December because the increased outflow in October and November also would increase the effective outflow in December if the baseline December outflow was low. The average simulated Rock Slough chloride concentration would be reduced from 64 mg/l for the baseline to 62 mg/l with project operations. Because the minimum chloride (without seawater intrusion) was assumed to be 17 mg/l, the reduction of 2 mg/l represents about 4% of the seawater intrusion at Rock Slough. This is considered to be a substantial benefit.

There is an additional salinity benefit that could be provided with the project. Delta levee failures can affect in-Delta and export water quality by drawing brackish water into the Delta from downstream. The Jones Tract flooding allowed about 150 taf from Suisun Bay to move into the central Delta. If a downstream island or multiple levees failed during relatively low Delta outflow (e.g., during an earthquake), the volume and salinity of the intrusion water would be greater. The levee improvements of the project would reduce the risk of levee failure and the subsequent seawater intrusion.

While not in the project description, the project could provide an emergency response during a Delta island flooding event. If the project islands were filled at the time, the stored water could be released to provide about 200 taf of flushing water to move the salinity intrusion water downstream. This emergency response could be a benefit. This effect is **beneficial**.

Mitigation Measure: No mitigation is required.

Table 3.11-5
Monthly Cumulative Distributions for IDSM-Simulated Chloride Concentration (mg/l) at Rock Slough Intake

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
A. Simulated EC at Jersey Point with Baseline Delta Conditions												
Min	17	17	17	17	17	17	17	17	17	17	17	17
10%	30	19	17	17	17	17	17	17	17	17	33	37
20%	77	52	17	17	17	17	17	17	17	19	40	74
30%	143	78	17	17	17	17	17	17	17	20	44	109
40%	161	136	36	17	17	17	17	17	18	22	48	116
50%	180	155	76	17	17	17	17	17	19	26	53	130
60%	196	175	108	22	17	17	17	18	23	29	69	138
70%	209	190	129	46	17	17	17	20	29	47	83	155
80%	217	200	152	85	19	17	18	23	35	51	95	179
90%	251	231	167	104	31	22	25	33	52	85	141	196
Max	271	275	216	173	118	74	61	87	133	150	170	236
Avg	160	139	83	43	22	19	19	23	30	40	68	125
B. Simulated EC at Jersey Point with Project Operations												
Min	17	17	17	17	17	17	17	17	17	17	17	17
10%	30	18	17	17	17	17	17	17	17	17	33	37
20%	77	35	17	17	17	17	17	17	17	19	40	74
30%	122	53	18	17	17	17	17	17	17	20	44	108
40%	136	82	35	17	17	17	17	17	18	22	48	113
50%	168	130	52	18	17	17	17	17	19	26	53	125
60%	192	165	82	22	17	17	17	18	23	29	69	138
70%	208	186	112	44	17	17	17	20	29	47	83	155
80%	217	197	141	77	19	17	18	23	35	51	95	179
90%	251	231	167	101	30	22	25	33	52	85	141	196
Max	271	275	216	173	118	74	61	87	133	150	170	236
Avg	154	125	76	42	22	19	19	23	30	40	68	124
C. Simulated Changes in EC at Jersey Point with Project Operations												
Min	-54	-75	-68	-23	-3	0	0	0	0	0	0	-21
10%	-23	-44	-28	-3	0	0	0	0	0	0	0	0
20%	-20	-29	-10	0	0	0	0	0	0	0	0	0
30%	-3	-20	-1	0	0	0	0	0	0	0	0	0
40%	0	-4	0	0	0	0	0	0	0	0	0	0
50%	0	0	0	0	0	0	0	0	0	0	0	0
60%	0	0	0	0	0	0	0	0	0	0	0	0
70%	0	0	0	0	0	0	0	0	0	0	0	0
80%	0	0	0	0	0	0	0	0	0	0	0	0
90%	0	0	0	0	0	0	0	0	0	0	0	0
Max	0	0	1	6	2	0	0	0	0	0	0	0
Avg	-7	-14	-7	-1	0	0	0	0	0	0	0	-1

Notes: EC = electrical conductivity; mg/l = millgrams per liter

Source: ICF 2010:4.2-56; adapted by AECOM in 2013

EFFECT WQ-8 **Elevated DOC Concentrations at Delta Export Facilities.** *Discharges from the project islands may have relatively high DOC concentrations that may substantially increase DOC concentrations in Delta exports. However, implementation of the WQMP would use monitoring and possible restrictions on storage island releases to minimize DOC effects on water quality at the urban intakes. Operational criteria of more than 1 mg/l TOC net increase or exceeding the 4 mg/l TOC threshold were established in the WQMP. Adherence to the WQMP ensures that this effect is less than significant.*

The potential DOC loading rate from the storage islands remains uncertain. However, treatment plant operations may not be quite as sensitive to the raw water DOC concentration as when chlorination was the initial treatment process. The WQMP allows treatment plant operators to specify the maximum permissible DOC increase from the project. Regardless of the potential DOC loading (i.e., peat soil leaching) rates, adherence to the WQMP requirements, which has been incorporated into the project as an environmental commitment, would assure that DOC effects would be less than significant.

The 2001 FEIS evaluated the contribution of DOC and salinity (bromide) from project operations to the treated water DBP concentrations. Because each municipal treatment plant uses different treatment processes to provide treated drinking water that meets all applicable drinking water regulations, this SEIS does not evaluate DBP concentration effects.

The WQMP criteria for DOC are more stringent than the thresholds of significance. Therefore, project compliance with the WQMP will ensure that DOC effects are less than significant. As described previously, the annual DOC loading (i.e., g-C/m2) during storage from the time of diversion to the time of discharge for export is uncertain. If the DOC loading were the same as observed on Jones Tract in 2004 (about 60 g-C/m2), the storage water DOC concentration would be about 12–15 mg/l, because the storage islands have a mean depth of about 5.5 m or 6 m (because concentration [mg/l] = load [g-C/m2]/depth [m]). This would limit the discharge from the storage islands to about 8% of the total exports, unless the DOC increase was determined by the treatment plant operators to be acceptable. In accordance with the WQMP, actual project operations would require a water quality model (e.g., DSM2) to account for DOC changes at the exports. The results of a more sophisticated model would be less than the conservative methods described above, which assumed that all project water ended up at the export facilities.

The WQMP includes procedures for each treatment plant operator to evaluate the effects of project discharges and approve the annual operating plan as well as short-term effects caused by increased DOC or bromide concentrations in the project storage water. This effect is **less than significant**.

Mitigation Measure: No mitigation is required.

EFFECT WQ-9 **Increased Methylmercury Loading in the Delta.** *The adopted mercury TMDL limits for methylmercury loading in the Delta require that there be no increase in methylmercury load in the central Delta. Any project that could increase methylmercury loading above existing conditions would cause a violation of the TMDL amendment to the Basin Plan. Most of the project area falls in the central Delta. Wetlands and open water of the Delta may produce slightly more methylmercury than agricultural practices on peat soils. This effect is potentially significant.*

Methylmercury studies in the Delta have produced estimates of methylmercury loading rates from agricultural land, open water, and wetlands. The estimated loading rates are similar but quite variable. Low and high estimates were applied to the acres for each land use type for each alternative to produce low and high estimates of loading rates associated with the project alternatives (Table 3.11-6). If the high estimate of methylmercury production for the No-Action Alternative is compared to the low estimate of methylmercury production for Alternatives 1 and 2, there would be no increase in methylmercury production associated with the project. Some studies have indicated that some wetlands do not produce methylmercury or could be methylmercury sinks. If this assumption was used for the wetlands and open water of the project, the conclusion would be that the project would reduce the production of methylmercury in the central Delta.

However, because wetlands and open water of the Delta may produce slightly more methylmercury than agricultural practices on peat soils, the project may have a significant effect on methylmercury loading in the central Delta. Therefore, this effect is **potentially significant**.

Mitigation Measure WQ-MM-1: Follow Guidelines from Proposed Delta TMDL for Methylmercury.

The 2011 TMDL Basin Plan amendments for mercury contain requirements for organizations that propose to create wetlands within the Delta. The project applicant will follow the requirements of the TMDL, which include:

- Participate in a management effort to evaluate and minimize health risks associated with eating fish contaminated with mercury (Wood et al. 2010b:BPA-15, BPA-16; Central Valley Regional Water Quality Board 2011).
- For phase 1 of the TMDL, participate in a monitoring program to evaluate methylmercury loading and procedures to minimize methylmercury loading from wetlands (Wood et al. 2010b:BPA-3; Central Valley Regional Water Quality Board 2011).
- For phase 2 of the TMDL, implement approved methylmercury control actions. These potential actions and their effectiveness are uncertain at this time. Other possible mitigation might involve an offset program (Wood et al. 2010b:ES-3, BPA-13; Central Valley Regional Water Quality Board 2011).

Mitigation Measure WQ-MM-2: Incorporate Mercury Methylation Control Measures in Wetland Design.

Certain actions such as permanent inundation or fall/winter inundation may help to reduce the formation of methylmercury in wetlands. As phase 1 of the TMDL is being implemented, knowledge about procedures to reduce methylmercury formation may improve. The project applicant would use any feasible procedures to reduce methyl mercury formation on the reservoir or habitat islands. This could include modifying the final CMP design or making changes later in response to new information. Proposed techniques (Wood et al. 2010a:31; Wood et al. 2010b:108) include taking the following actions:

- modifying wetland design (e.g., depth, period of inundation, and vegetation),
- reducing discharge of water with high concentrations of methylmercury, and trapping sediment with actions such as creating settling basins or planting appropriate types of vegetation (in order to reduce discharge of methylmercury attached to sediment).

Implementing Mitigation Measures WQ-MM-1 and WQ-MM-2 would reduce this effect to a **less-than-significant** level because the project would be in compliance with the Delta methylmercury TMDL implementation plan and mercury methylation control measures would be incorporated into the design of project wetlands.

EFFECT WQ-10 **Changes in Other Water Quality Variables in Delta Channel Receiving Waters.** *Discharges of stored water from the Reservoir Islands may adversely affect channel water quality near the discharge locations. The FOC for fish protection identified discharge limits for temperature and DO, and the WQMP includes monitoring and adjustment of project operations for turbidity and other variables. The project is required to implement the FOC as part of the USFWS and NMFS BOs and adhere to the WQMP. This effect is less than significant.*

Table 3.11-6
Estimates of Methylmercury Load from Project Islands for all Alternatives

	Agricultural/Other Land		Open Water		Wetlands		Estimated Total Load (g/yr)	
	Low Flux	High Flux	Low Flux	High Flux	Low Flux	High Flux	Low Flux	High Flux
Net Flux (ng/m^2/day)	0.3–3.3[1]	4.45	7.7[3]	10	7.7[3]	25.07[4]		
No-Action Alternative Acres	19,074[2]	19,074[2]	237	237	1,870	1,870		
Alternative 1 and 2 Acres	7,611[2]	7,611[2]	9,273	9,273	4,297	4,297		
Alternative 3 Acres	0	0	21,181	21,181	0	0		
No-Action Alternative Load (g/yr)	37.5	125.4	2.7	3.5	21.3	69.3	61.5	198.1
Alternative 1 and 2 Load (g/yr)	25.4	50.0	105.5	137.0	48.9	159.1	179.8	346.1
Alternative 3 Load (g/yr)	0	0.0	240.9	312.9	0.0	0.0	240.9	312.9
Sources	Heim et al. 2009	Wood et al. 2010a	Sassone et al. 2008	Wood et al. 2010a	Sassone et al. 2008	Wood et al. 2010a		

Notes: ng/m2/day = nanograms per square meter per day; g/yr = grams per year

1 Range of values assigned to the different Project islands. Value used in the calculation was a weighted average for the 4 islands (No-Action) or a weighted average for the two habitat islands (Alternatives 1 and 2).

2 Acres calculated as total island area minus open water and wetland acres.

3 Value for Twitchell Island East Pond, a flow-through wetland that is continuously inundated.

4 Weighted average for year based on early Twitchell Island West Pond results.

Source: ICF 2010: 4.2-57; adapted by AECOM in 2013

The FOC, BOs, and WQMP are environmental commitments that have been incorporated as part of the project. These documents set temperature and DO limits, and require monitoring for other water quality variables such as turbidity and total dissolved solids, along with associated adjustment of project operations as necessary, that the project must comply with to ensure that discharges of water from the Reservoir Islands do not adversely affect water quality. Therefore, this effect is **less than significant**.

Mitigation Measure: No mitigation is required.

EFFECT WQ-11 **Water Pollution Caused by Construction Activities.** *Construction activities could introduce contaminants into adjacent water bodies. Primary construction-related contaminants that could reach groundwater or surface water consist of increased sediment and oil and grease. Because the project incorporates effective BMPs to reduce water pollution caused by construction, this effect is less than significant.*

Project actions would require construction-related earth-disturbing activities that potentially could cause erosion and sedimentation of adjacent water bodies. Furthermore, some activities may require in-water work that could result in greater sedimentation and increased turbidity in comparison to activities that are primarily on the land side.

In addition, project actions may involve storage, use, or discharge of toxic and other harmful substances near Delta channels. Construction activities would involve the use of heavy equipment, cranes, compactors, and other construction equipment that uses petroleum products (e.g., fuels, lubricants, hydraulic fluids, coolants). All of these materials may be toxic to fish and other aquatic organisms. An accidental spill or inadvertent discharge of these materials could affect the water quality of the river or water body. Furthermore, any dewatering of the construction area (e.g., trenches may fill with water) could result in the release of contaminants to surface or groundwater.

The environmental commitment to use BMPs (described in Chapter 2, “Project Description and Alternatives,” and in Subsection 3.11.1 above) would reduce the likelihood that construction-related water quality effects would occur, and would reduce any effect that does occur. With adherence to the BMPs, construction-related effects on water quality would be **less than significant**.

Mitigation Measure: No mitigation is required.

EFFECT WQ-12 **Increase in Pollutant Loading in Delta Channels Associated with Recreational Boating.** *No new recreational facilities would be constructed as part of the project. Occasional use of the new boat docks that would be required for project operations and maintenance would not result in a substantial increase in pollutant loading in Delta channels. This effect is less than significant.*

No new recreational facilities would be constructed as part of the project. Occasional use of the new boat docks that would be required for project operations and maintenance would not result in a substantial increase in pollutant loading in Delta channels. This effect is **less than significant**.

Mitigation Measure: No mitigation is required.

Alternative 3

EFFECT WQ-1 **Hydrodynamic Effects on Local Channel Velocities and Stages From Project Diversions and Discharges**. *Modeling results indicate that project effects on local channel velocities and stages would be small and within the range of conditions normally encountered in the Delta. This effect is less than significant.*

The hydrodynamic simulation results for the maximum possible initial daily average diversion and discharge rates under Alternative 3 (ICF 2001: 3B-21 and 3B-22) indicated that maximum possible channel velocities and stages are within the range of conditions normally encountered during tidal fluctuations in the Delta channels surrounding the project islands and changes are small. This effect is **less than significant**.

Mitigation Measure: No mitigation is required.

EFFECT WQ-2	Hydrodynamic Effects on Net Channel Flows*. Modeling results indicate that project effects on net channel flows would be small and within the range of conditions normally encountered in the Delta. This effect is less than significant.*

The hydrodynamic simulation results for net channel flows under Alternative 3 (ICF 2001: 3B-22) indicated that all simulated changes are small and well within the historical range of Delta channel flows at the locations selected for assessment. This effect is **less than significant**.

Mitigation Measure: No mitigation is required.

EFFECT WQ-3	Salinity Increase at Chipps Island. *The simulated project operations for this SEIS require a minimum outflow of about 11,400 cfs (i.e., X2 downstream of Chipps Island) during diversions. Because the project is required to comply with operational restrictions contained in the WQMP, this effect is less than significant.*

For the same reasons discussed under Alternatives 1 and 2, restrictions on project operations under Alternative 3 are likely to maintain adequately low levels of salinity in the Delta. As part of project operations, minimum Delta outflow would be about 11,400 cfs, and X2 (the location of 2,640 µS/cm) would be at Chipps Island or downstream. In addition, one of the restrictions of the WQMP is that the project should not cause salinity to exceed 90% of an adopted salinity standard. Because of project operational restrictions, this effect is **less than significant**.

Mitigation Measure: No mitigation is required.

EFFECT WQ-4	Salinity Increase at Emmaton. *There are essentially no salinity intrusion effects at Emmaton for outflow greater than 10,000 cfs. The simulated project operations for this SEIS require a minimum outflow of about 11,400 cfs during diversions, the simulated EC changes at Emmaton would be small, and project diversions would only occur in the months of December-March when there are no established salinity objectives at Emmaton. This effect is less than significant.*

For the same reasons discussed under Alternatives 1 and 2, there are essentially no salinity intrusion effects at Emmaton for outflow greater than 10,000 cfs under Alternative 3. Because project operations would maintain a minimum Delta outflow of approximately 11,400 cfs, the effect of Alternative 3 on salinity at Emmaton would be small, and project diversions would only occur in the months of December-March when there are no established salinity objectives at Emmaton. Therefore, this effect is **less than significant**.

Mitigation Measure: No mitigation is required.

EFFECT WQ-5	Salinity Increase at Jersey Point. *There are essentially no salinity intrusion effects at Jersey Point for outflow greater than 10,000 cfs. The simulated project operations for this SEIS require a minimum outflow of about 11,400 cfs during diversions, the simulated EC changes at Jersey Point would be small, and project diversions would only occur in the months of December-March when there are no established salinity objectives at Jersey Point. This effect is less than significant.*

As discussed under Alternatives 1 and 2, there are essentially no salinity intrusion effects at Jersey Point for outflow greater than 10,000 cfs. Because project operations under Alternative 3 would maintain a minimum Delta outflow of approximately 11,400 cfs, the effect of Alternative 3 on salinity at Jersey Point would be small, and project diversions would only occur in the months of December-March when there are no established salinity objectives at Jersey Point. Therefore, this effect is **less than significant**.

Mitigation Measure: No mitigation is required.

EFFECT WQ-6 **Salinity Increase at Delta Export Facilities.** *There are essentially no salinity intrusion effects at Delta export facilities for outflow greater than 10,000 cfs. Because project operations would maintain a minimum Delta outflow of about 11,400 cfs, the effect of Alternative 3 on Delta salinity would be small, and this effect is less than significant.*

As described above for Alternatives 1 and 2, there are essentially no salinity intrusion effects at the Rock Slough intake for outflow greater than 10,000 cfs. Because project operations would maintain a minimum Delta outflow of about 11,400 cfs under Alternative, the effect of Alternative 3 on Delta salinity would be small, and this effect is **less than significant**.

Mitigation Measure: No mitigation is required.

EFFECT WQ-7 **Beneficial Salinity Reductions at Delta Export Facilities.** *Because the simulated project operations for this SEIS simulate the release of project storage water in October and November in years when the water could not be exported for delivery to designated places of use or to the groundwater banks, there are substantial increases in Delta outflow that reduce the export salinity. This effect is beneficial.*

Alternative 3 would create beneficial salinity reductions for the same reasons as described above for Alternatives 1 and 2. However, because there is potential to store and release more water under Alternative 3, the potential decrease in salinity in fall is greater for Alternative 3 than it is for Alternatives 1 and 2.

As for Alternatives 1 and 2, the levee improvements needed to implement Alternative 3 would reduce the risk of levee failure and subsequent seawater intrusion.

Furthermore, the project could provide an emergency response during a Delta flood event. If the project islands were filled at the time, the stored water could be released to provide about 350 taf of flushing water (more than for Alternatives 1 and 2) to move the salinity intrusion water downstream. This emergency response could be a benefit. This effect is **beneficial**.

Mitigation Measure: No mitigation is required.

EFFECT WQ-8 **Elevated DOC Concentrations at Delta Export Facilities.** *Discharges from the project islands may have relatively high DOC concentrations that may substantially increase DOC concentrations in Delta exports. However, implementation of the WQMP requires monitoring and restrictions on storage island releases to minimize DOC effects on water quality at the urban intakes. Operational criteria of more than 1 mg/l TOC net increase or exceeding the 4 mg/l TOC threshold were established in the WQMP. Because the project is required to comply with the WQMP criteria, this effect is less than significant.*

Discharges from the project islands may have relatively high DOC concentrations that may substantially increase DOC concentrations in Delta exports. As described above for Alternatives 1 and 2, reservoir releases would be subject to the restrictions of the WQMP. Because the volume of water to be released under Alternative 3 is potentially greater than for Alternatives 1 and 2, it could be more difficult to quickly release all of the water for export use. However, implementation of the WQMP requires monitoring and restrictions on storage island releases to minimize DOC effects on water quality at the urban intakes. Operational criteria of more than 1 mg/l DOC net increase or exceeding the 4 mg/l DOC threshold were established in the WQMP. Because the project is required to comply with the WQMP criteria, this effect is **less than significant**.

Mitigation Measure: No mitigation is required.

EFFECT WQ-9 Increased Methylmercury Loading in the Delta. *The adopted mercury TMDL limits for methylmercury loading in the Delta require that there be no increase in methylmercury load in the central Delta. Any project that could increase methylmercury loading above existing conditions could cause a violation of the TMDL amendment to the Basin Plan. Most of the project area falls in the central Delta. Wetlands and open water of the Delta may produce slightly more methylmercury than agricultural practices on peat soils. This effect is potentially significant.*

As indicated in Table 3.11-6, mercury loading under Alternative 3 may or may not be greater than under Alternatives 1 and 2 depending on the actual mercury flux rates from reservoirs versus wetlands. In any case, because both wetlands and open water impoundments of the Delta appear typically to produce more methylmercury than agricultural practices on peat soils, Alternative 3 may have a significant effect on methylmercury loading in the central Delta. Therefore, this effect is **potentially significant**.

Mitigation Measure: Implement Mitigation Measure WQ-MM-1 (Follow Guidelines from Proposed Delta TMDL for Methylmercury).

Mitigation Measure: Implement Mitigation Measure WQ-MM-2 (Incorporate Mercury Methylation Control Measures in Wetland Design).

Implementing Mitigation Measures WQ-MM-1 and WQ-MM-2 would reduce this potentially significant effect to a **less-than-significant** level because the project would be in compliance with the Delta methylmercury TMDL implementation plan and mercury methylation control measures would be incorporated into the design of project wetlands.

EFFECT WQ-10 Changes in Other Water Quality Variables in Delta Channel Receiving Waters. *Discharges of stored water from project islands may adversely affect channel water quality near the discharge locations. The FOC for fish protection identified discharge limits for temperature and DO, and the WQMP includes monitoring and adjustment of project operations for turbidity and other variables. The project is required to implement the FOC as part of the USFWS and NMFS BOs and adhere to the WQMP. This effect is less than significant.*

Under Alternative 3, all four islands would be used for water storage. Regardless of how many islands are used for water storage, the FOC, BOs, and WQMP are environmental commitments that have been incorporated as part of the project. These documents set temperature and DO limits, and require monitoring for other water quality variables such as turbidity and total dissolved solids, along with associated adjustment of project operations as necessary, that the project must comply with to ensure that discharges of water from the project islands do not adversely affect water quality. Therefore, this effect is **less than significant**.

Mitigation Measure: No mitigation is required.

EFFECT WQ-11 Water Pollution Caused by Construction Activities. *Construction activities could introduce contaminants into adjacent water bodies. Primary construction-related contaminants that could reach groundwater or surface water consist of increased sediment and oil and grease. Because the project incorporates effective BMPs to reduce water pollution caused by construction, this effect is less than significant.*

As discussed previously under Alternatives 1 and 2, construction activities could introduce contaminants into adjacent water bodies. More construction work would be needed for Alternative 3 than for Alternatives 1 and 2 because a larger area of land would be inundated and therefore more facilities would be constructed, but the nature of potential water pollution from construction activities is the same for all three alternatives.

As discussed in detail in Subsection 3.11.1, the project has incorporated environmental commitments to prepare and implement BMPs specifically designed to avoid erosion and contaminant spills. Implementation of these BMPs would reduce the likelihood that construction-related water quality effects would occur, and would reduce any effect that does occur. With adherence to the BMPs, construction-related effects on water quality would be **less than significant**.

Mitigation Measure: No mitigation is required.

EFFECT WQ-12 Increase in Pollutant Loading in Delta Channels Associated with Recreational Boating. *No new recreational facilities would be constructed as part of the project. Occasional use of the new boat docks that would be required for project operations and maintenance would not result in a substantial increase in pollutant loading in Delta channels. This effect is less than significant.*

No new recreational facilities would be constructed as part of the project. Occasional use of the new boat docks that would be required for project operations and maintenance would not result in a substantial increase in pollutant loading in Delta channels. This effect is **less than significant**.

Mitigation Measure: No mitigation is required.

Table 3.11-7
Comparison of Delta Wetlands Project 2001 FEIS to this SEIS Effects and Mitigation Measures for Hydrology and Water Quality

2001 FEIS Effects and Mitigation Measures	SEIS Effects and Mitigation Measures
Alternatives 1 and 2 (Proposed Action)	
Impact B-1: Hydrodynamic Effects on Local Channel Velocities and Stages during Maximum DW Diversions **Mitigation:** No mitigation is required	**Effect WQ-1:** Hydrodynamic Effects on Local Channel Velocities and Stages During Project Diversions and Discharges (LTS) **Mitigation:** No mitigation is required
Impact B-2: Hydrodynamic Effects on Local Channel Velocities and Stages during Maximum DW Discharges **Mitigation:** No mitigation is required	This effect is now analyzed as part of Effect WQ-1.
Impact B-3: Hydrodynamic Effects on Net Channel Flows (LTS) **Mitigation:** No mitigation is required	**Effect WQ-2:** Hydrodynamic Effects on Net Channel Flows (LTS) **Mitigation:** No mitigation is required No change.
Impact C-1: Salinity (EC) Increase at Chipps Island during Months with Applicable EC Objectives (LTS) **Mitigation Measure C-1:** Restrict DW Diversions to Limit EC Increases at Chipps Island	**Effect WQ-3:** Salinity Increase at Chipps Island (LTS) **Mitigation:** No mitigation is required Changes have been incorporated into the project to reduce the severity of this effect.

Table 3.11-7
Comparison of Delta Wetlands Project 2001 FEIS to this SEIS Effects and Mitigation Measures for Hydrology and Water Quality

2001 FEIS Effects and Mitigation Measures	SEIS Effects and Mitigation Measures
Impact C-2: Salinity (EC) Increase at Emmaton (LTS-M) **Mitigation Measure C-2:** Restrict DW Diversions to Limit EC Increases at Emmaton	**Effect WQ-4:** Salinity Increase at Emmaton (LTS) **Mitigation:** No mitigation is required. Changes have been incorporated into the project to reduce the severity of this effect.
Impact C-3: Salinity (EC) Increase at Jersey Point (LTS-M) **Mitigation Measure C-3:** Restrict DW Diversions to Limit EC Increases at Jersey Point	**Effect WQ-5:** Salinity Increase at Jersey Point (LTS) **Mitigation:** No mitigation is required. Changes have been incorporated into the project to reduce the severity of this effect.
Impact C-4: Salinity (Chloride) Increase in Delta Exports (LTS) **Mitigation Measure C-4:** Restrict DW Diversions or Discharges to Limit Chloride Concentrations in Delta Exports	**Effect WQ-6:** Salinity Increase at Delta Export Facilities (LTS) **Mitigation:** No mitigation is required. Changes have been incorporated into the project to reduce the severity of this effect.
Not previously analyzed	**Effect WQ-7:** Beneficial Salinity Reductions at Delta Export Facilities (B) **Mitigation:** No mitigation is required.
Impact C-5: Elevated DOC Concentrations in Delta Exports (CCWD Rock Slough, SWP Banks, CVP Tracy) (LTS-M) **Mitigation Measure C-5:** Restrict DW Discharges to Prevent DOC Increases of Greater Than 0.8 mg/l in Delta Exports	**Effect WQ-8:** Elevated DOC Concentrations at Delta Export Facilities (LTS) **Mitigation:** No mitigation is required. Changes have been incorporated into the project to reduce the severity of this effect.
Not previously analyzed	**Effect WQ-9:** Increased Methylmercury Loading in the Delta (LTS-M) **Mitigation Measure WQ-MM-1:** Follow Guidelines from Proposed Delta TMDL for Mercury **Mitigation Measure WQ-MM-2:** Incorporate Mercury Methylation Control Measures in Wetland Design
Impact C-6: Elevated THM Concentrations in Treated Drinking Water from Delta Exports (CCWD Rock Slough, SWP Banks, and CVP Tracy) (LTS-M) **Mitigation Measure C-6:** Restrict DW Discharges to Prevent Increases of More Than 16µg/l in THM Concentrations or THM Concentrations of Greater Than 72µg/l in Treated Delta Export Water	THM is a disinfection by-product. The formation of THM is dependent on the concentration of DOC and processes used at water treatment plants. Because control of DOC through implementation of WQ-MM-1 and WQ-MM-2 would control the formation of THM, THM is not evaluated separately.
Impact C-7: Changes in Other Water Quality Variables in Delta Channel Receiving Waters (LTS-M) **Mitigation Measure C-7:** Restrict DW Discharges to Prevent Adverse Changes in Delta Channel Water Quality	**Effect WQ-10:** Changes in Other Water Quality Variables in Delta Channel Receiving Waters (LTS) **Mitigation:** No mitigation is required. Changes have been incorporated into the project to reduce the severity of this effect.
Not previously analyzed	**Effect WQ-11:** Water Pollution Caused by Construction Activities (LTS) **Mitigation:** No mitigation is required.

Table 3.11-7
Comparison of Delta Wetlands Project 2001 FEIS to this SEIS Effects and Mitigation Measures for Hydrology and Water Quality

2001 FEIS Effects and Mitigation Measures	SEIS Effects and Mitigation Measures
Not previously analyzed	**Effect WQ-12:** Increase in Pollutant Loading in Delta Channels Associated with Recreational Boating (LTS) **Mitigation:** No mitigation is required.
Alternative 3	
Impact B-4: Hydrodynamic Effects on Local Channel Velocities and Stages during Maximum DW Diversions **Mitigation:** No mitigation is required	**Effect WQ-1:** Hydrodynamic Effects on Local Channel Velocities and Stages During Project Diversions and Discharges (LTS) **Mitigation:** No mitigation is required No change.
Impact B-5: Hydrodynamic Effects on Local Channel Velocities and Stages during Maximum DW Discharges **Mitigation:** No mitigation is required	This effect is now analyzed as part of Effect WQ-1.
Impact B-6: Hydrodynamic Effects on Net Channel Flows (LTS) **Mitigation:** No mitigation is required	**Effect WQ-2:** Hydrodynamic Effects on Net Channel Flows (LTS) **Mitigation:** No mitigation is required No change.
Impact C-9: Salinity (EC) Increase at Chipps Island during Months with Applicable EC Objectives (LTS-M) **Mitigation Measure C-1:** Restrict DW Diversions to Limit EC Increases at Chipps Island	**Effect WQ-1:** Salinity Increase at Chipps Island (LTS) **Mitigation:** No mitigation is required. Changes have been incorporated into the project to reduce the severity of this effect.
Impact C-10: Salinity (EC) Increase at Emmaton during April-August (LTS-M) **Mitigation Measure C-2:** Restrict DW Diversions to Limit EC Increases at Emmaton	**Effect WQ-2:** Salinity Increase at Emmaton (LTS) **Mitigation:** No mitigation is required. Changes have been incorporated into the project to reduce the severity of this effect.
Impact C-11: Salinity (EC) Increase at Jersey Point during April-August (LTS-M) **Mitigation Measure C-3:** Restrict DW Diversions to Limit EC Increases at Jersey Point	**Effect WQ-3:** Salinity Increase at Jersey Point (LTS) **Mitigation:** No mitigation is required. Changes have been incorporated into the project to reduce the severity of this effect.
Impact C-12: Salinity (Chloride) Increase in Delta Exports (LTS-M) **Mitigation Measure C-4:** Restrict DW Diversions or Discharges to Limit Chloride Concentrations in Delta Exports	**Effect WQ-4:** Salinity Increase at Delta Export Facilities (LTS) **Mitigation:** No mitigation is required. Changes have been incorporated into the project to reduce the severity of this effect.
Not previously analyzed	**Effect WQ-5:** Beneficial Salinity Reductions at Delta Export Facilities (B) **Mitigation:** No mitigation is required.
Impact C-13: Elevated DOC Concentrations in Delta Exports (CCWD Rock Slough, SWP Banks, CVP Tracy) (LTS-M) **Mitigation Measure C-5:** Restrict DW Discharges to	**Effect WQ-6:** Elevated DOC Concentrations at Delta Export Facilities (LTS) **Mitigation:** No mitigation is required. Changes have been incorporated into the project to reduce

Table 3.11-7 Comparison of Delta Wetlands Project 2001 FEIS to this SEIS Effects and Mitigation Measures for Hydrology and Water Quality	
2001 FEIS Effects and Mitigation Measures	SEIS Effects and Mitigation Measures
Prevent DOC Increases of Greater Than 0.8 mg/l in Delta Exports	the severity of this effect.
Not previously analyzed	**Effect WQ-7:** Increased Methylmercury Loading in the Delta (LTS-M) **Mitigation Measure WQ-MM-1:** Follow Guidelines from Proposed Delta TMDL for Mercury **Mitigation Measure WQ-MM-2:** Incorporate Mercury Methylation Control Measures in Wetland Design
Impact C-14: Elevated THM Concentrations in Treated Drinking Water from Delta Exports (CCWD Rock Slough, SWP Banks, and CVP Tracy) (LTS-M) **Mitigation Measure C-6:** Restrict DW Discharges to Prevent Increases of More Than 16 µg/l in THM Concentrations or THM Concentrations of Greater Than 72 µg/l in Treated Delta Export Water	THM is a disinfection by-product. The formation of THM is dependent on the concentration of DOC and processes used at water treatment plants. Because control of DOC through implementation of WQ-MM-1 and WQ-MM-2 would control the formation of THM, THM is not evaluated separately.
Impact C-15: Changes in Other Water Quality Variables in Delta Channel Receiving Waters (LTS-M) **Mitigation Measure C-7:** Restrict DW Discharges to Prevent Adverse Changes in Delta Channel Water Quality	**Effect WQ-8:** Changes in Other Water Quality Variables in Delta Channel Receiving Waters (LTS) **Mitigation:** No mitigation is required. Changes have been incorporated into the project to reduce the severity of this effect.
Not previously analyzed	**Effect WQ-9:** Water Pollution Caused by Construction Activities (LTS). **Mitigation:** No mitigation is required
Not previously analyzed	**Effect WQ-10:** Increase in Pollutant Loading in Delta Channels Associated with Recreational Boating (LTS) **Mitigation:** No mitigation is required.
Note: Shading denotes changes in the effect, significance conclusion, or mitigation measure from the 2001 FEIS; SU = Significant and unavoidable; LTS = Less than significant; LTS-M = Less than significant with mitigation; B = Beneficial Sources: ICF 2010:4.2-2 through 4.2-5 and AECOM 2014	

3.11.6 SECONDARY AND CUMULATIVE EFFECTS

Secondary and cumulative effects on water quality resulting from project implementation were described in the 2001 FEIS (Chapter 3C) and 2010 DEIR (Chapter 5). The 2001 FEIS and 2010 DEIR are herein incorporated by reference, and the effect conclusions and mitigation measures, along with any changes, are summarized briefly below and shown in Table 3.11-8.

The 2001 FEIS identified several cumulative water quality effects that were the same type of effects as the project-level effects. Cumulative water quality effects are bound by the requirements and existing controls mandated by various regulatory measures, such as the D-1641objectives and the RWQCB basin plans, TMDL implementation programs, NPDES discharge permits, and USFWS and NMFS BOs.

Future activities affecting water quality in the Delta would include continued agricultural and municipal diversions, discharges from treated municipal wastewater and agricultural drainage, and maintenance of existing channels and levees. New facilities (e.g., channel gates and barriers) may be constructed, and existing channels may be modified for navigation or for increased water conveyance (e.g., DWR/Reclamation South Delta Improvements Program [SDIP]) or a buried isolated transfer facility to convey water from a new set of Sacramento River intakes near Freeport to Clifton Court Forebay could be constructed and operated (e.g., Bay Delta Conservation Plan). These potential projects have numerous hurdles to overcome and may not be considered to be reasonably foreseeable at this time.

Some existing agricultural lands may be converted to urban development or to wetlands and other wildlife habitat uses, changing the water diversion and discharge patterns for these lands. Increasing populations in the watershed may result in higher concentrations of water quality variables associated with wastewater and increased surface runoff.

The types of water quality effects described at the project level are the same as those that would occur at the cumulative level. The magnitude of the effects also is not expected to change substantially at the cumulative level. The project's less-than-significant water quality effects are not likely to become significant effects at the cumulative level because the same basic water quality control programs will govern any future changes in the Delta for any project.

Hydrodynamics Effects from Diversions and Discharges in the Delta

Cumulative hydrodynamic impacts were assessed qualitatively. Delta Wetland project effects on hydrodynamic conditions are inextricably tied to past and present hydraulic modifications that have been made in the Delta for various beneficial purposes, such as levee construction for land reclamation and flood control; channel dredging for navigation and levee maintenance; channel enlargement and deepening for navigation; operation of diversion pumps, siphons, and drainage pumps; and construction and operation of export pumping plants (CVP Tracy Pumping Plant, SWP Clifton Court and Banks Pumping Plant) and associated facilities for water management (i.e., the DCC and the Suisun Marsh salinity control gate). Section 3.0, "Approach to the Environmental Analysis and the Cumulative Context," of this SEIS provides an updated list of the many projects in the Delta and other related water projects that have been considered as part of the cumulative analysis for hydrodynamics and water quality. Because the basic tidal hydraulics that control local channel velocities and stages are not expected to change substantially under cumulative future conditions, the hydrodynamic effects of maximum project diversions and discharge under cumulative future conditions are expected to be similar to those described at the project level; that is, less than significant. Therefore, the project would not result in a cumulatively considerable contribution to any significant cumulative impacts that could occur from modified hydrodynamics in the Delta.

Hydrodynamics Effects on Net Channel Flows in the Delta

Under future conditions, the full physical capacity (10,300 cfs) at SWP Banks Pumping Plant was assumed. Use of full capacity at the Banks Pumping Plant may require implementation of DWR's South Delta Project to provide sufficient channel conveyance and Clifton Court diversion capacity, to protect agricultural diversion siphons and pumps at low tidal stages, and to maintain water quality that is sufficient for south Delta irrigation uses. This may allow flows in the Old River and Middle River channels during periods of maximum Delta exports that are higher than historical flows. Project-related discharges would contribute to these channel flows during periods with available water for diversion and during periods with available export pumping capacity for project discharges.

Pumping at full SWP capacity would increase by about 3,620 cfs (6,680 cfs to 10,300 cfs), which is the total export capacity of the SWP pumps. Because the Old River and Middle River channels each carry about half of the export flow (not supplied by diversion from the San Joaquin River at the head of Old River), the increased assumed pumping rate under cumulative conditions would be expected to increase the maximum net flow in the Old and Middle River channels by about 1,800 cfs each. However, because tidal flows in these channels are substantial under No-Action conditions, these channels (with modifications included in the DWR South Delta Project) are expected to provide sufficient flow conveyance for maximum export pumping without any hydrodynamic impacts from channel scouring or other hydraulic effects (i.e., navigation or recreation effects).

Nevertheless, because the possible hydrodynamic effects of project operations on south Delta channels under cumulative future conditions is uncertain at this time, the Delta Wetlands project would result in a cumulatively considerable contribution to a significant cumulative hydrodynamic effect, therefore, this effect is considered potentially significant.

> Mitigation Measure CM-WQ-1: Operate the DW Project to Prevent Unacceptable Hydrodynamic Effects in the Middle River and Old River Channels During Flows That Are Higher Than Historical Flows.
>
> USGS and DWR tidal flow measurements (i.e., velocities and stages) in south Delta channels, as well as tidal hydrodynamic model simulations, should be used to determine the effects of project operations, and project operations should be controlled to prevent unacceptable hydrodynamic conditions in south Delta channels. Measures that may be used to prevent unacceptable hydrodynamic effects include establishing minimum tidal stages and maximum channel velocities. Project discharges would be reduced or eliminated during these extreme tidal conditions.

Implementing Mitigation Measure CM-WQ-1 would reduce the project's contribution to a potentially significant cumulative impact to a less-than-significant level because project discharges would be reduced or eliminated if Delta channel flows were higher than measured historical flows.

Changes in Future Delta Water Quality

Delta water quality could be affected by new actions taken by the projects considered in this cumulative analysis such as habitat restoration (i.e., the potential for increased DOC), improved wastewater treatment, increased generation of wastewater associated with growing population size, and changes in volume and quality of agricultural return flows. Degraded baseline water quality could restrict project operations in order to avoid not meeting water quality objectives, whereas improved baseline Delta water quality could result in fewer restrictions on project operations. However, the contribution of the project's operations, when considered in combination with these variations in future baseline conditions, would not be cumulatively considerable or cause a significant cumulative effect because the project would operate in compliance with the WQMP criteria.

Improvements in Water Treatment Procedures

Many EPA MCL objectives, as well as water treatment regulations, are likely to be revised in the future. Many water treatment plants have responded to recent regulatory changes by using coagulation to remove DOC and using chloramines or ozone instead of chlorination for disinfection. Health concerns about the effects of DOC and bromide on DBP concentrations should diminish over time, as drinking water treatment techniques improve. As concerns about DOC decrease, potential WQMP restrictions on project operations may relax. In any case, the project is required to adhere to the WQMP, which includes operations criteria based on DBP regulation. These criteria would limit project discharges, unless the treatment plant operators agree that the additional water supply or other benefit of the project would compensate for the increased treatment expenses. Therefore, project effects and improvements in regional water treatment procedures would result in a beneficial cumulative effect.

Improved Central Valley Project and State Water Project Water Quality Resulting from Increased Use of Sacramento River Water

If an isolated conveyance facility or improved through-Delta conveyance facilities are constructed, possible effects on the project operations would depend on the Delta operating procedures. With an isolated conveyance facility and increased pumping capacity, there could be less water available for project diversions, but there likely would be more unused capacity to export the project water. With an isolated conveyance facility in place, project water could be used to meet requirements such as Delta outflow and thereby allow increased exports of clean Sacramento River water in the isolated conveyance facility. Urban intakes that remain in the Delta could receive a higher percentage of water from project discharges, but the project's potential contribution to these water quality effects at these urban intakes still would be controlled by required compliance with the WQMP. Therefore, no significant cumulative adverse water quality effects are likely, and this future cumulative effect is beneficial.

Increase in Pollutant Loading in Delta Channels Associated with Recreational Boating

No new recreational facilities would be constructed as part of the Delta Wetlands project. Occasional use of the new boat docks that would be required for project operations and maintenance would not result in a substantial increase in pollutant loading in Delta channels. Therefore, although increases in pollutant loading caused by increased recreational use from other related projects in the Delta could themselves result in a cumulatively significant effect, the project would not contribute to this cumulative effect.

Table 3.11-8
Comparison of Secondary and Cumulative Hydrology and Water Quality Effects between the 2001 FEIS and this SEIS

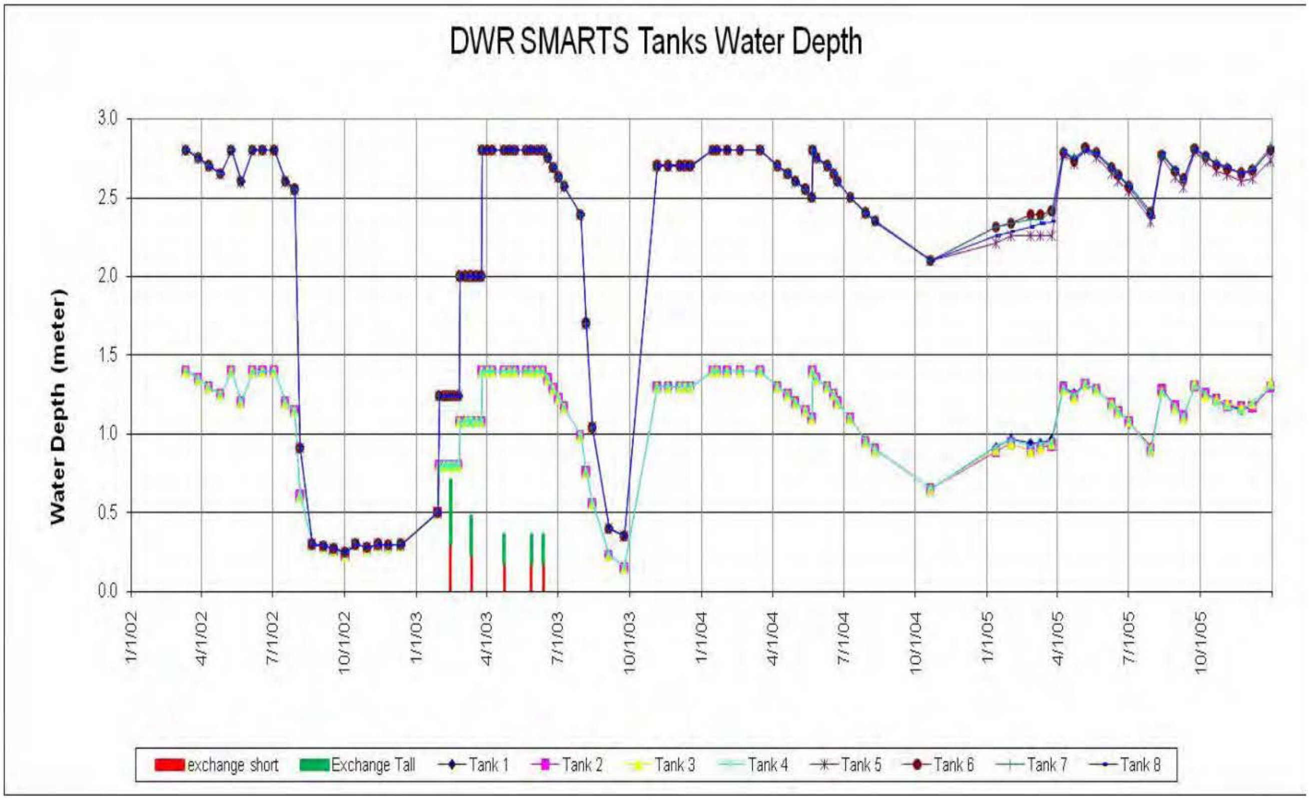
2001 FEIS Cumulative Effects and Mitigation Measures	SEIS Cumulative Effects and Mitigation Measures
Impact B-7: Cumulative Hydrodynamic Effects on Local Channel Velocities and Stages during Maximum DW Diversions (NCC) **Mitigation:** No mitigation is required.	Hydrodynamics Effects from Diversions and Discharges in the Delta (NCC) **Mitigation:** No mitigation is required. The analysis and conclusions have not changed, but the effects from diversions and discharges have been combined together.
Impact B-8: Cumulative Hydrodynamic Effects on Local Channel Velocities and Stages during Maximum DW Discharges (NCC) **Mitigation:** No mitigation is required.	This effect has been combined with the effect from diversions (above). The analysis and conclusions have not changed.
Impact B-9: Cumulative Hydrodynamic Effects on Net Channel Flows (NCC-M) **Mitigation Measure B-1:** Operate the DW Project to Prevent Unacceptable Hydrodynamic Effects in the Middle River and Old River Channels During Flows That are Higher Than Historical Flows	Cumulative Hydrodynamic Effects on Net Channel Flows (NCC-M) **Mitigation Measure CM-WQ-1:** Operate the DW Project to Prevent Unacceptable Hydrodynamic Effects in the Middle River and Old River Channels During Flows That are Higher Than Historical Flows No change.
Impact C-17: Salinity (EC) Increase at Chipps Island during Months with Applicable EC Objectives under Cumulative Conditions (NCC) **Mitigation Measure C-1:** Restrict DW Diversions to Limit EC Increases at Chipps Island	This is no longer considered a cumulative effect. Effects on salinity at Chipps Island are addressed under Effect WQ-1, and are not expected to be any different under cumulative conditions.
Impact C-18: Salinity (EC) Increase at Emmaton under Cumulative Conditions (NCC-M) **Mitigation Measure C-2:** Restrict DW Diversions to Limit EC Increases at Emmaton	This is no longer considered a cumulative effect. Effects on salinity at Emmaton are addressed under Effect WQ-2, and are not expected to be any different under cumulative conditions.
Impact C-19: Salinity (EC) Increase at Jersey Point under Cumulative Conditions (NCC-M) **Mitigation Measure C-3:** Restrict DW Diversions to Limit EC Increases at Jersey Point	This is no longer considered a cumulative effect. Effects on salinity at Jersey Point are addressed under Effect WQ-3, and are not expected to be any different under cumulative conditions.
Impact C-20: Salinity (Chloride) Increase in Delta Exports under Cumulative Conditions (NCC)	This is no longer considered a cumulative effect. Effects on salinity in Delta exports are addressed under Effect WQ-4,

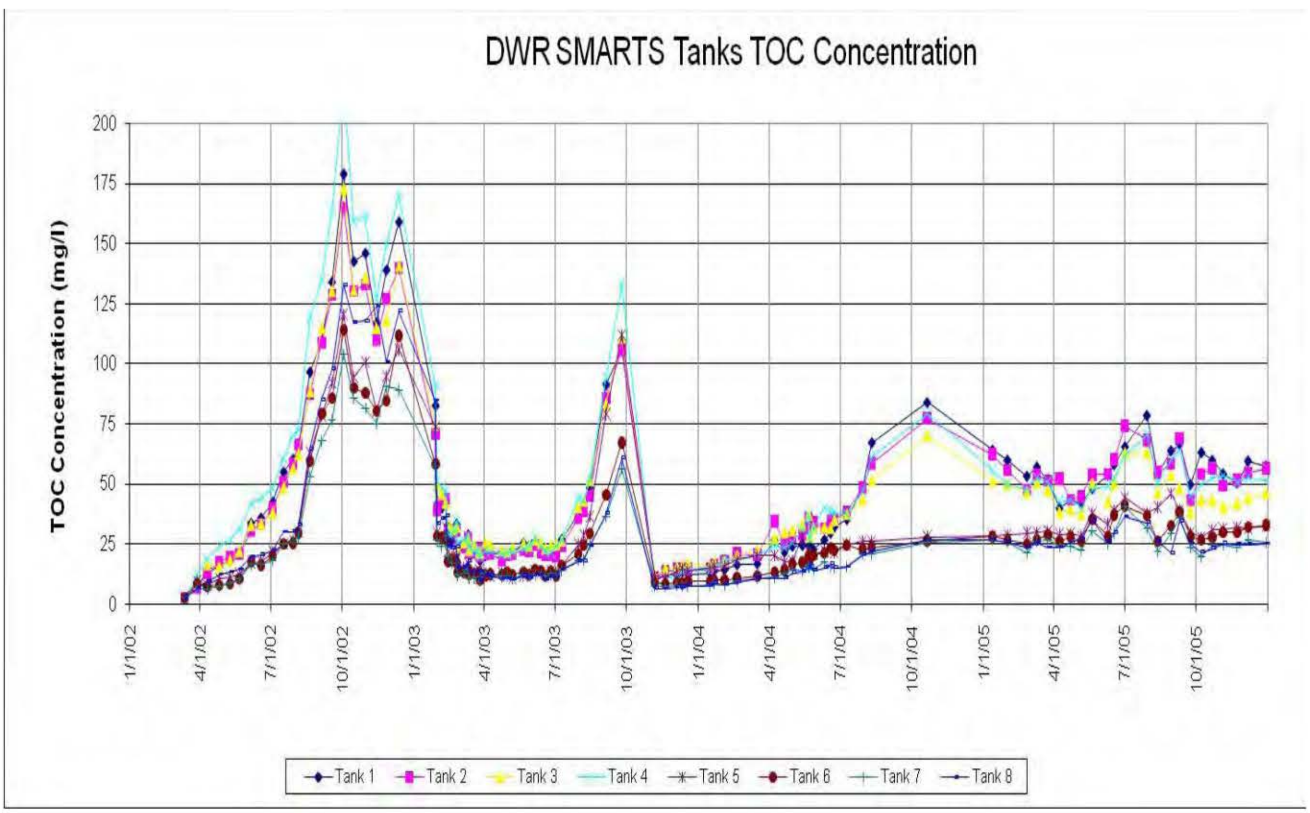
Table 3.11-8
Comparison of Secondary and Cumulative Hydrology and Water Quality Effects between the 2001 FEIS and this SEIS

2001 FEIS Cumulative Effects and Mitigation Measures	SEIS Cumulative Effects and Mitigation Measures
Mitigation Measure C-4: Restrict DW Diversions or Discharges to Limit Chloride Concentrations in Delta Exports	and are not expected to be any different under cumulative conditions.
Impact C-21: Elevated DOC Concentrations in Delta Exports (CCWD Rock Slough, SWP Banks, CVP Tracy) under Cumulative Conditions (NCC-M) **Mitigation Measure C-5:** Restrict DW Discharges to Prevent DOC Increases of Greater Than 0.8 mg/l in Delta Exports	This is no longer considered a cumulative effect. Effects on DOC concentrations in Delta exports are addressed under Effect WQ-6, and are not expected to be any different under cumulative conditions.
Impact C-22: Elevated THM Concentrations in Treated Drinking Water from Delta Exports (CCWD Rock Slough, SWP Banks, CVP Tracy) under Cumulative Conditions (NCC-M) **Mitigation Measure C-6:** Restrict DW Discharges to Prevent Increases of More Than 16 µg/l in THM Concentrations or THM Concentrations of Greater than 72 µg/l in Treated Delta Export Water	This is no longer considered a cumulative effect. THM is no longer evaluated because THM concentration would depend on DOC concentrations and operations at each water treatment plant. Effects on THM concentrations in drinking water from the Delta are tracked in the WQMP and addressed under Effect WQ-6 for DOC, and are not expected to be any different under cumulative conditions.
Impact C-23: Changes in Other Water Quality Variables in Delta Channel Receiving Waters under Cumulative Conditions (NCC-M) **Mitigation Measure C-7:** Restrict DW Discharges to Prevent Adverse Changes in Delta Channel Water Quality	This is no longer considered a cumulative effect. Effects on other water quality variables in Delta channel receiving waters are addressed under Effect WQ-8, and are not expected to be any different under cumulative conditions.
Impact C-24: Increase in Pollutant Loading in Delta Channels (CCU) **Mitigation Measure C-9:** Clearly Post Waste Discharge Requirements, Provide Waste Collection Facilities, and Educate Recreationists regarding Illegal Discharges of Waste **Mitigation Measure RJ-1:** Reduce the Number of Outward Boat Slips Located at the Proposed Recreation Facilities	Increase in Pollutant Loading in Delta Channels Associated with Recreational Boating (NCC) **Mitigation:** No mitigation is required. The effects analysis and mitigation measures have been changed to reflect the fact that no new recreational facilities would be built.

Notes: Shading denotes changes in the effect, significance conclusion, or mitigation measure from the 2001 FEIS; CCU = Cumulatively considerable and unavoidable; NCC = Not cumulatively considerable; NCC-M = Not cumulatively considerable with mitigation; B = Beneficial

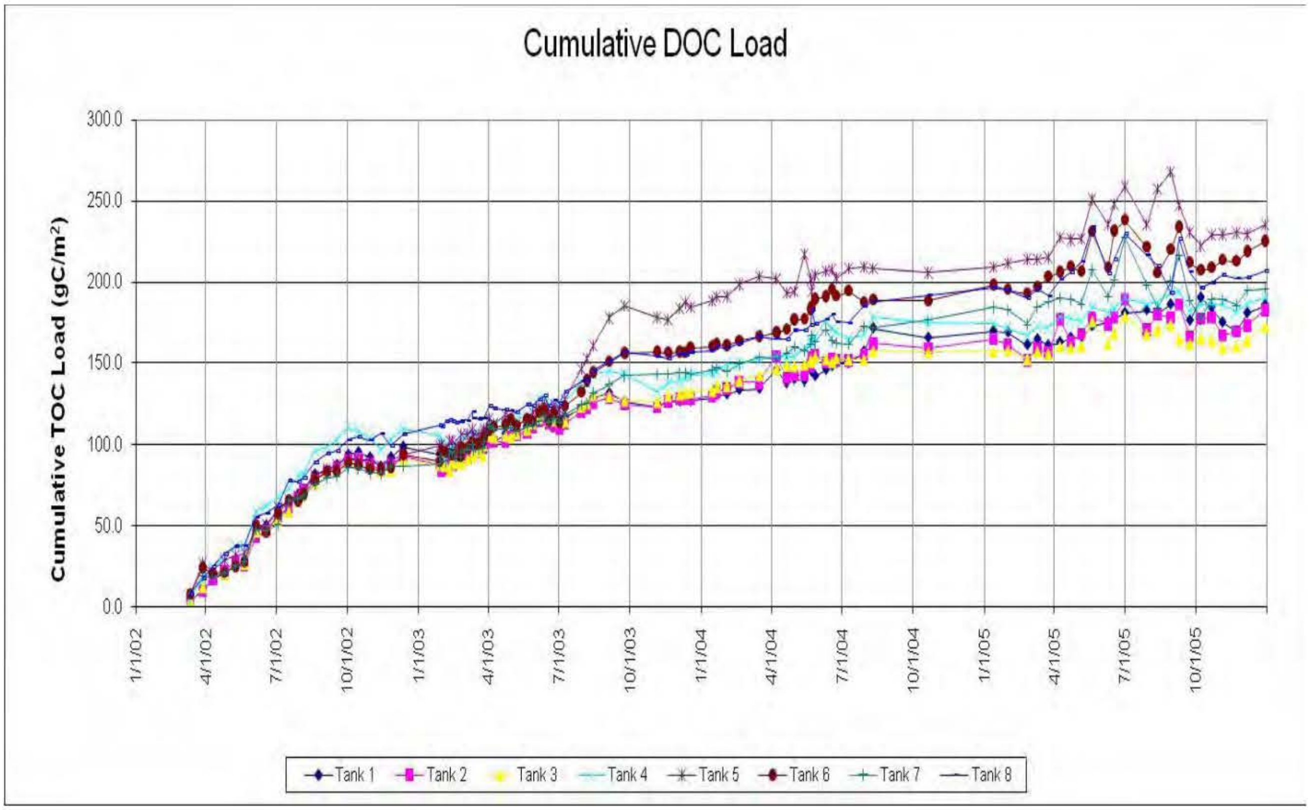
Sources: ICF 2010:5-30 through 5-31 and AECOM 2014

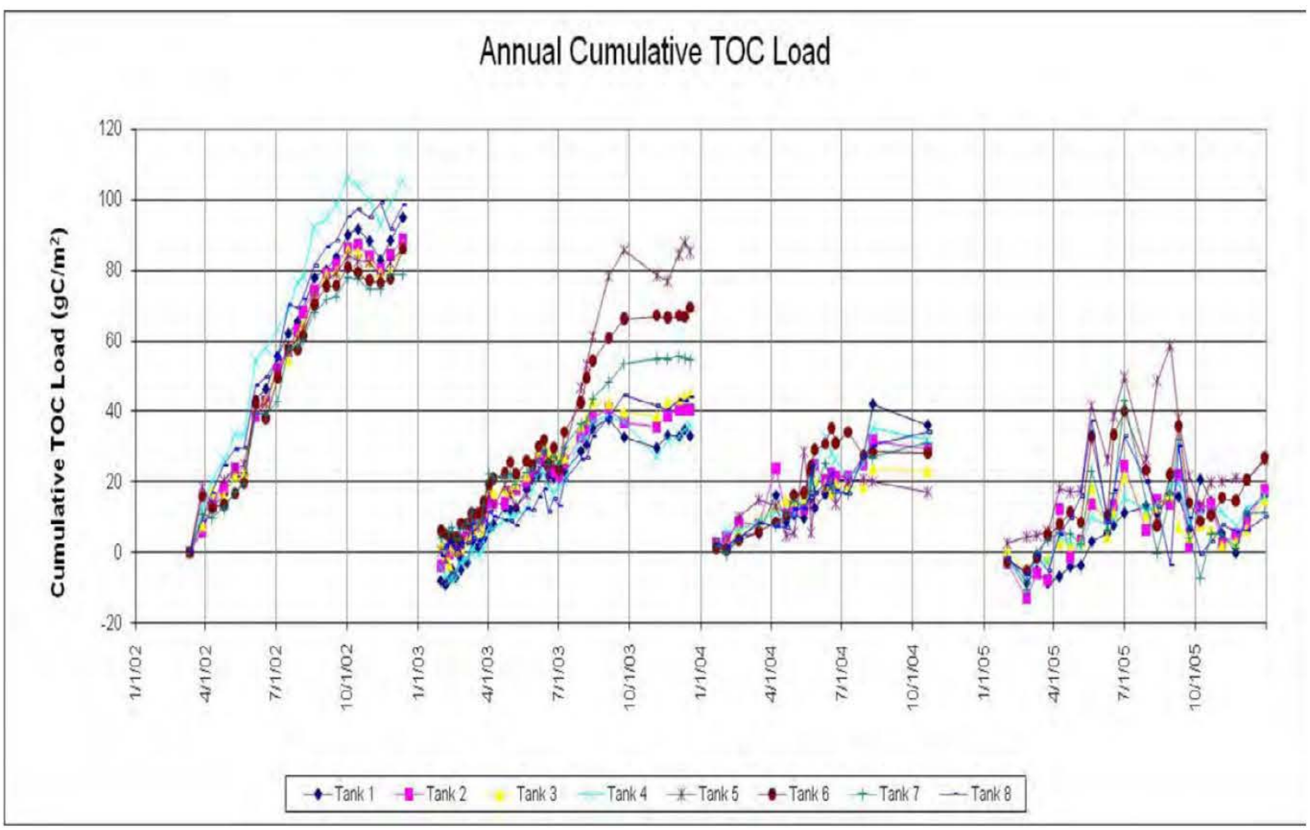




Source: ICF 2010; adapted by AECOM in 2013

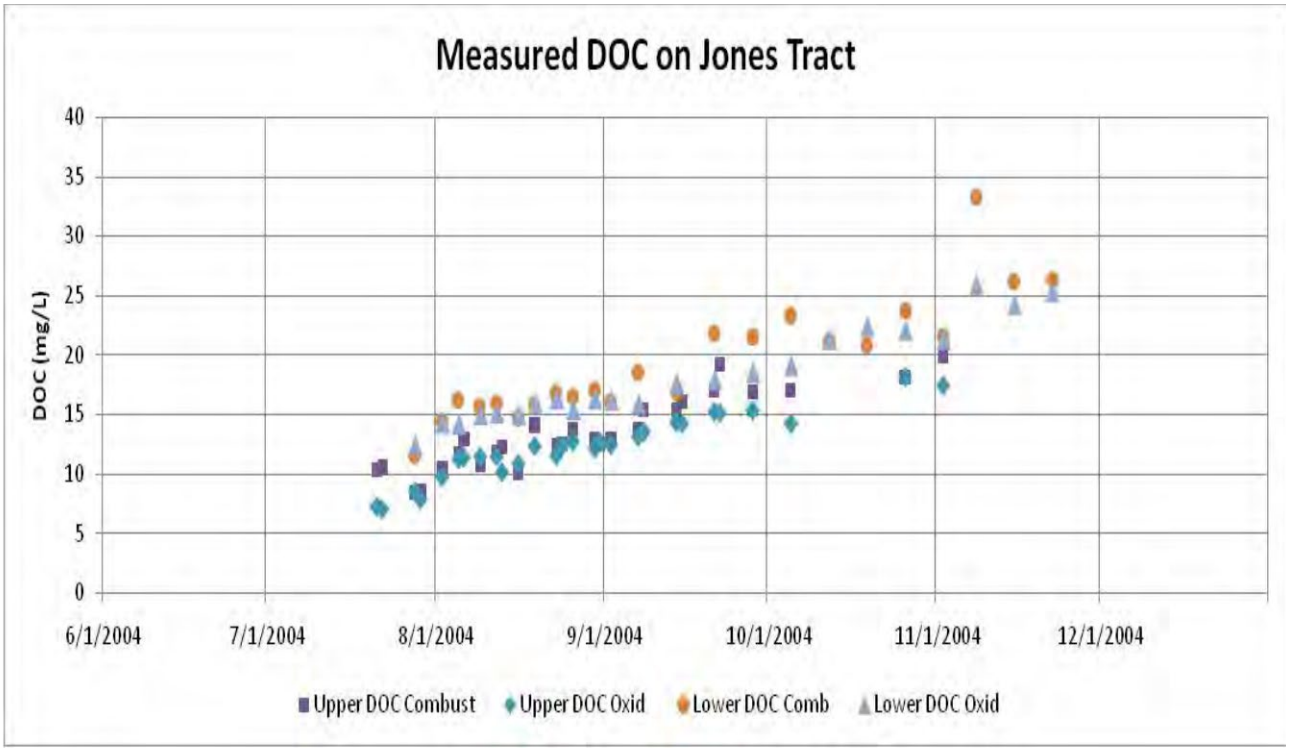
Exhibit 3.11-1 Measurements of SMARTS Tank Water Depth (m) and TOC (mg/l) for 2002–2005





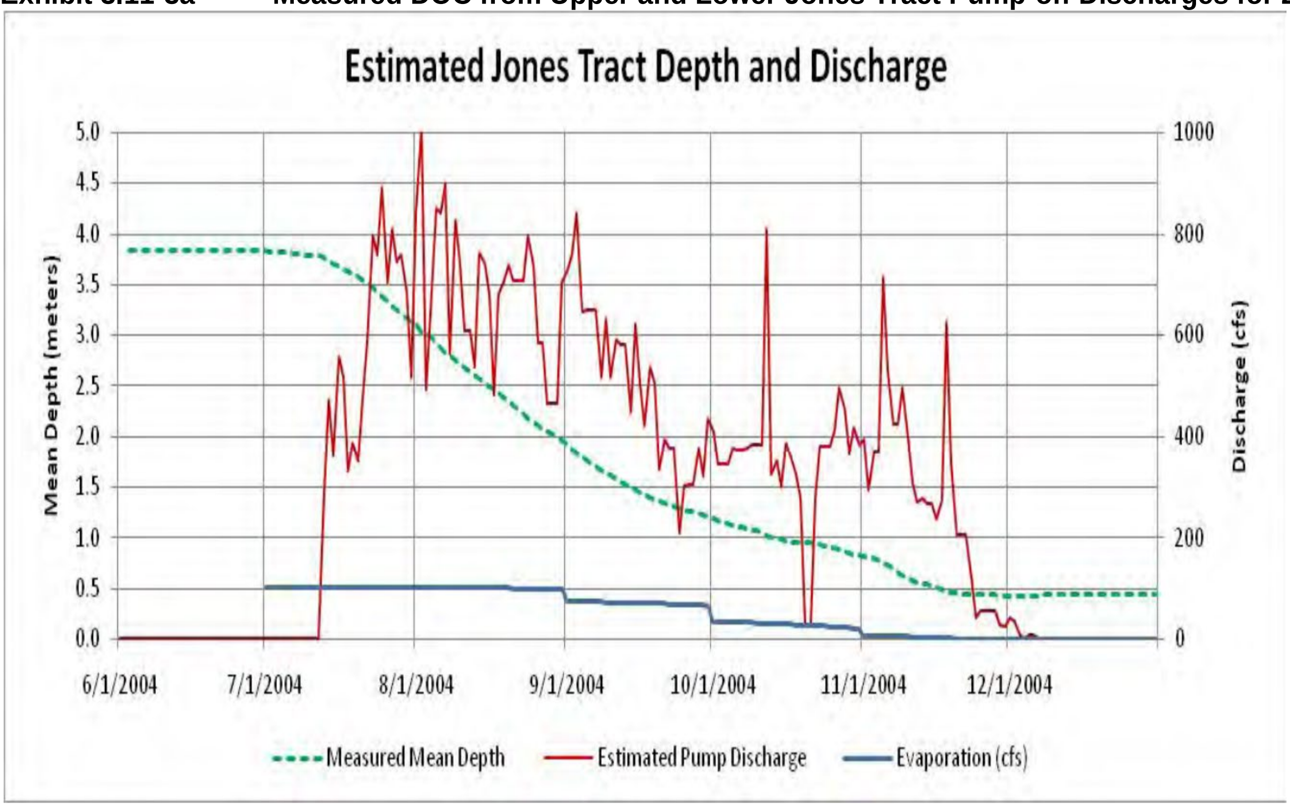
Source: ICF 2010; adapted by AECOM in 2013

Exhibit 3.11-2 Calculated Cumulative and Annual TOC Loads (g/m^2) for SMARTS Tanks for 2002–2005



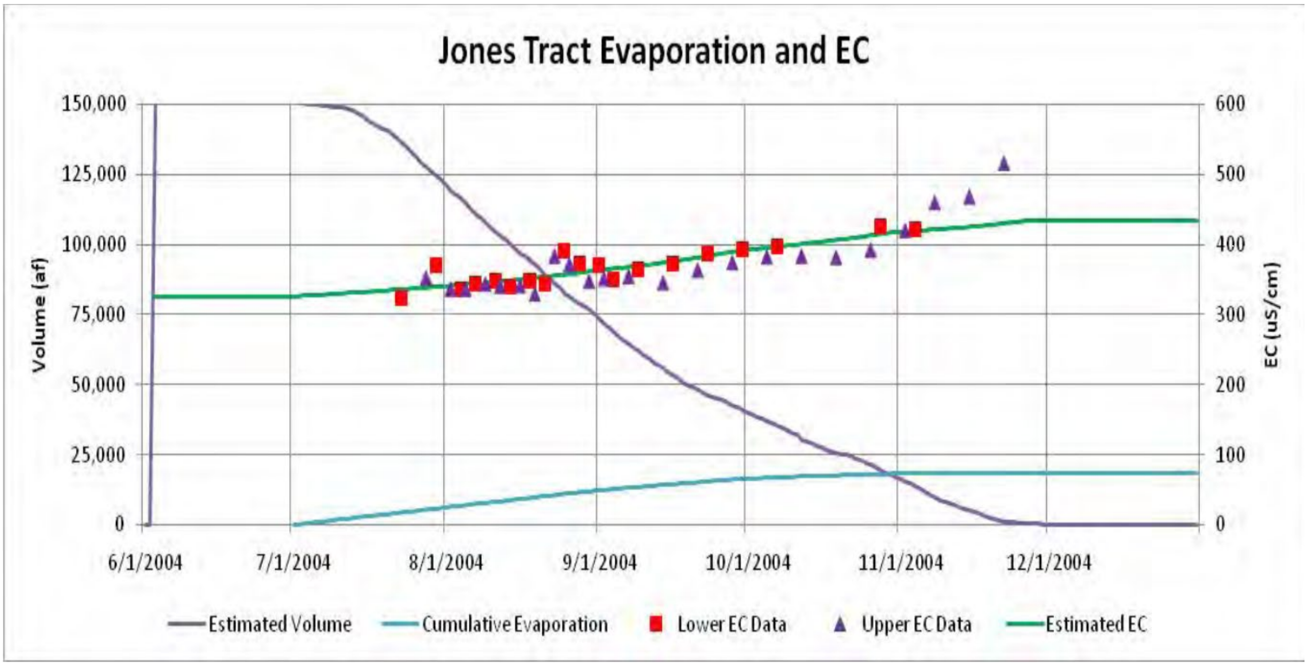
Source: ICF 2010; adapted by AECOM in 2013

Exhibit 3.11-3a Measured DOC from Upper and Lower Jones Tract Pump-off Discharges for 2004



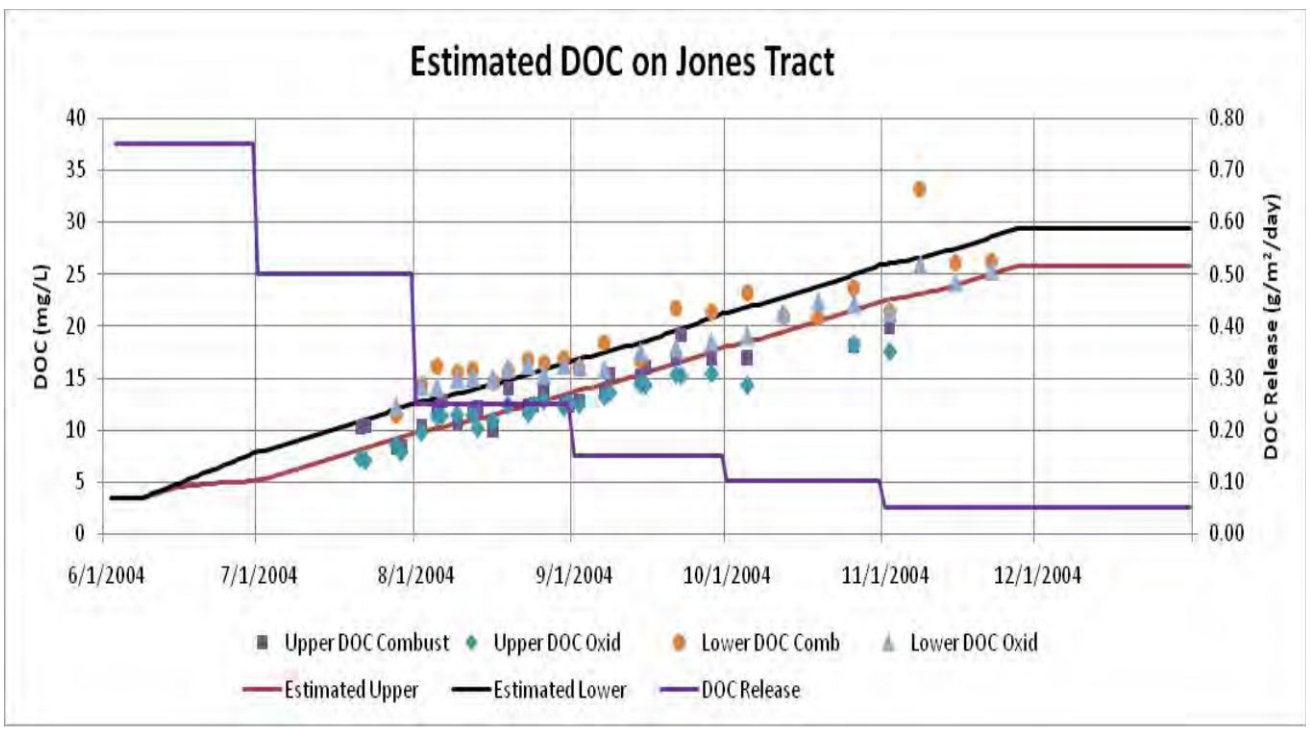
Source: ICF 2010; adapted by AECOM in 2013

Exhibit 3.11-3b Calculated Jones Tract Mean Depth (m) and Daily Discharge (cfs) for June–December 2004



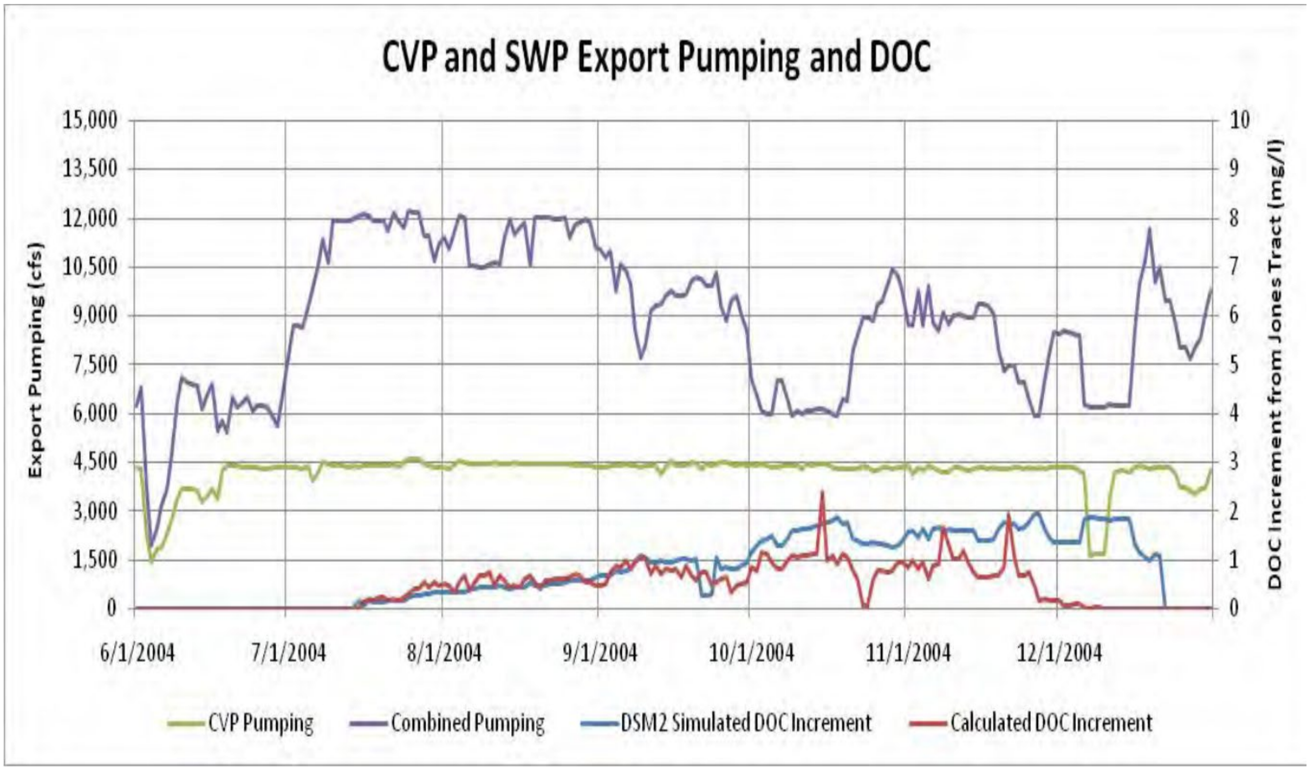
Source: ICF 2010; adapted by AECOM in 2013

Exhibit 3.11-4a **Measured Jones Tract EC and Estimated Evaporation and EC for July–November 2004**



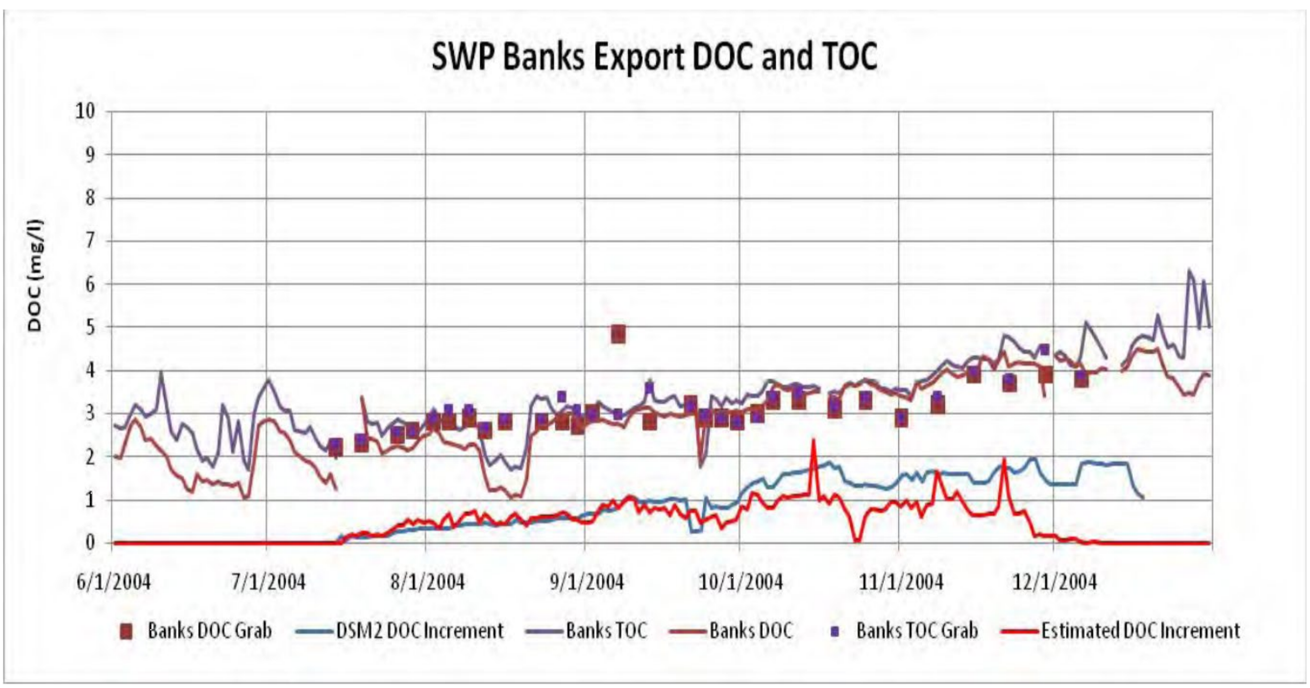
Source: ICF 2010; adapted by AECOM in 2013

Exhibit 3.11-4b **Estimated Monthly DOC Release Rates and Estimated DOC Concentrations for Upper and Lower Jones Tract for June–November 2004**



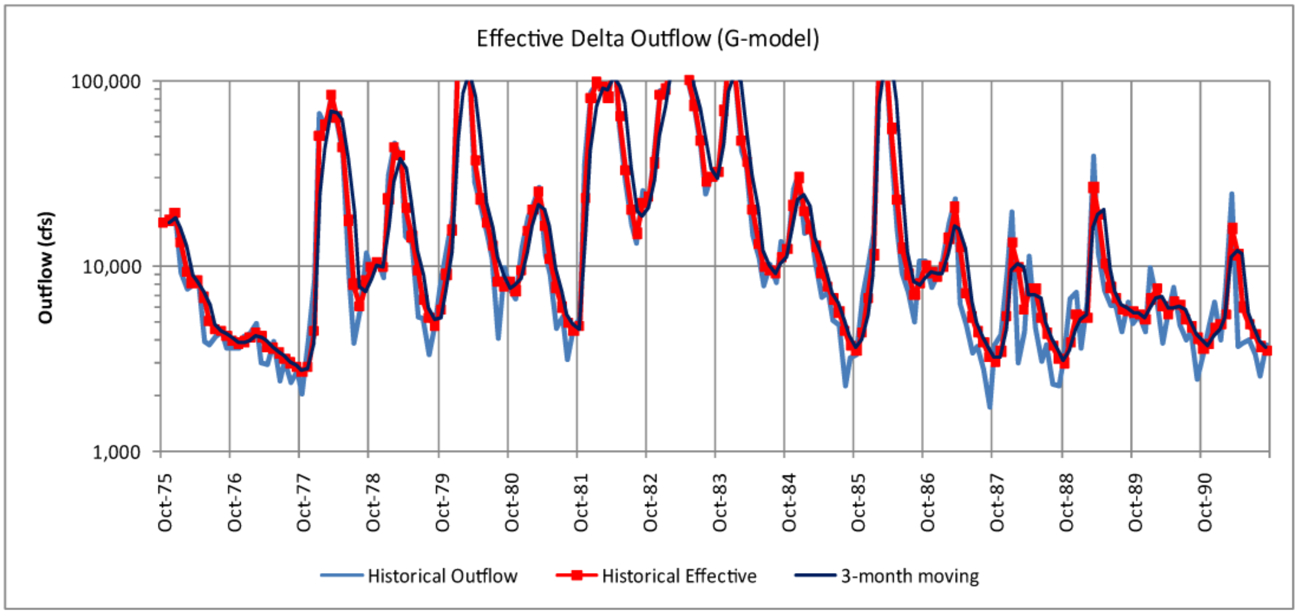
Source: ICF 2010; adapted by AECOM in 2013

Exhibit 3.11-5a CVP and SWP Export Pumping and Estimated DOC Increments from Jones Tract Discharge for June–December 2004



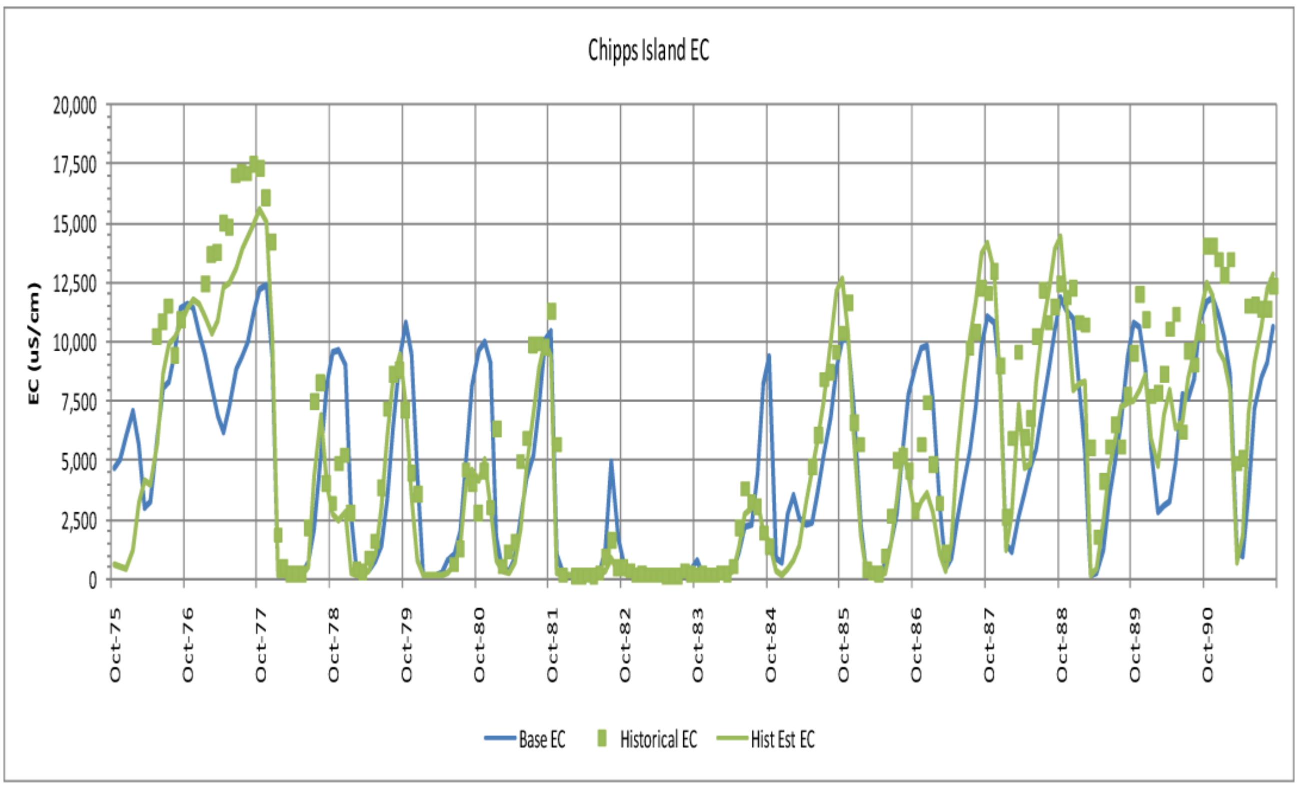
Source: ICF 2010; adapted by AECOM in 2013

Exhibit 3.11-5b Measured DOC and TOC at SWP Banks Export Pumping Plant with Estimated DOC Increments from Jones Tract Discharge for June–December 2004



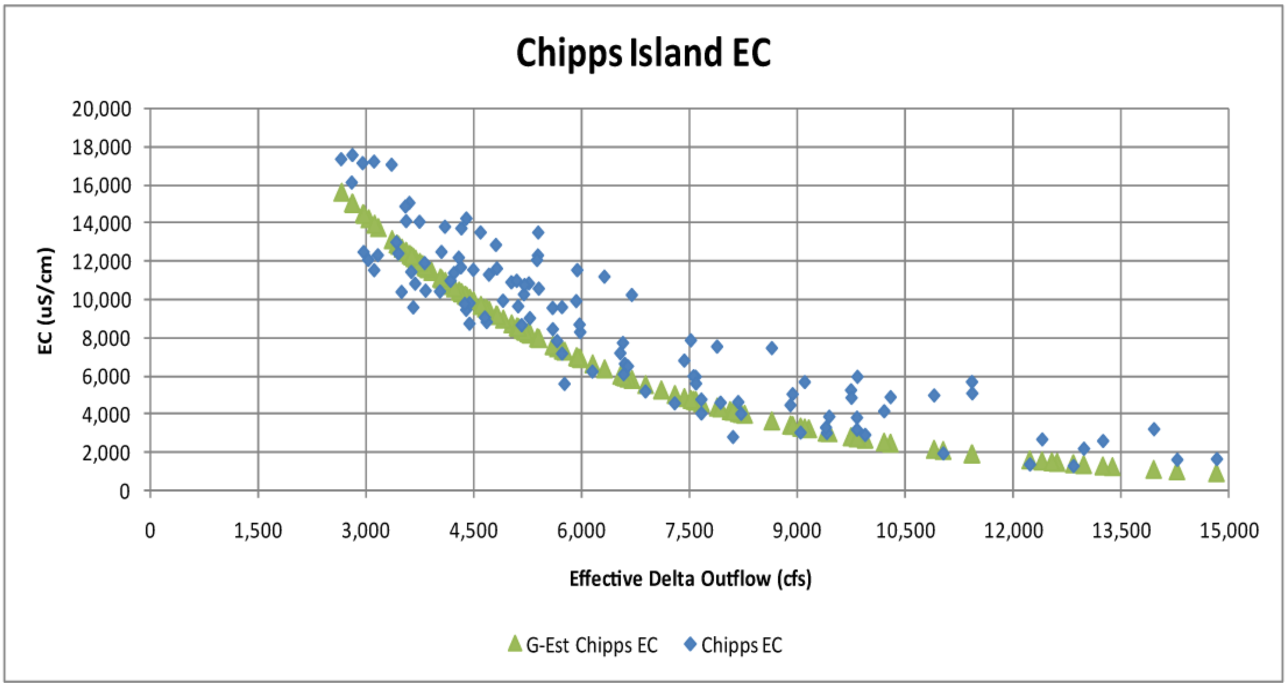
Source: ICF 2010; adapted by AECOM in 2013

Exhibit 3.11-6a Historical Monthly Delta Outflow and Effective Delta Outflow (Using the CCWD G-Model Relationships for Water Year 1976–1991



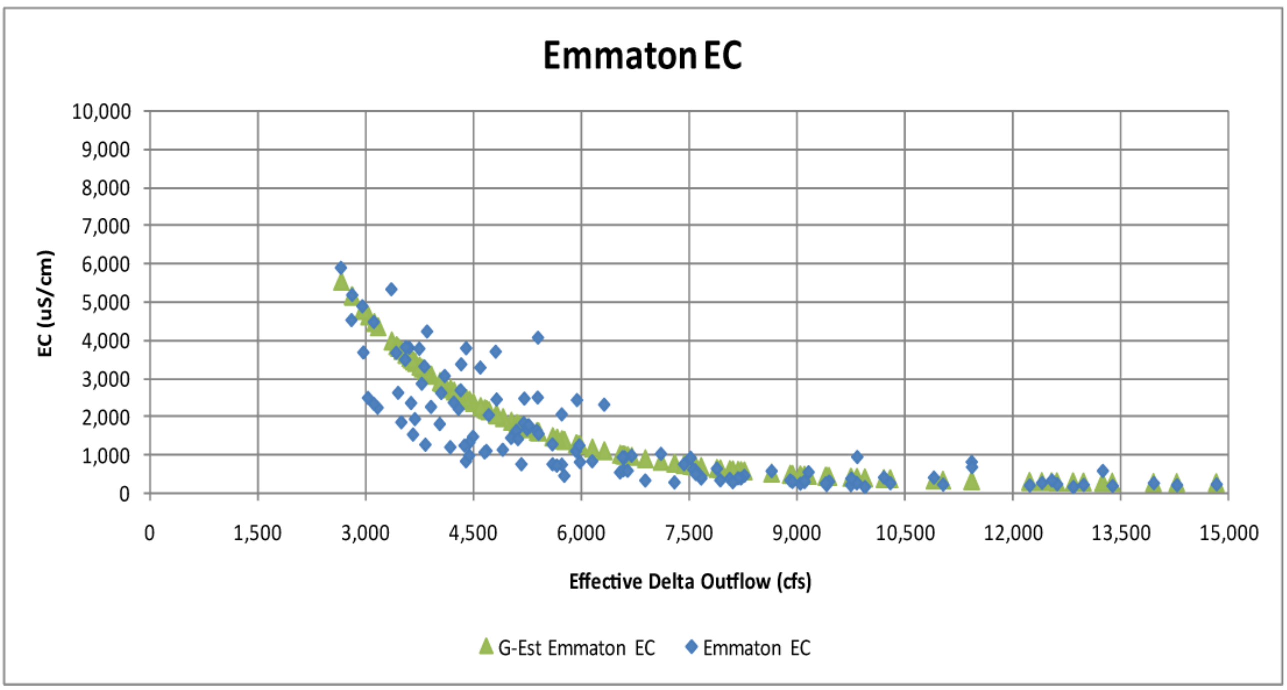
Source: ICF 2010; adapted by AECOM in 2013

Exhibit 3.11-6b Historical and Calculated EC at Chipps Island (Using Negative Exponential Relationship with Effective Outflow) for Water Years 1976–1991



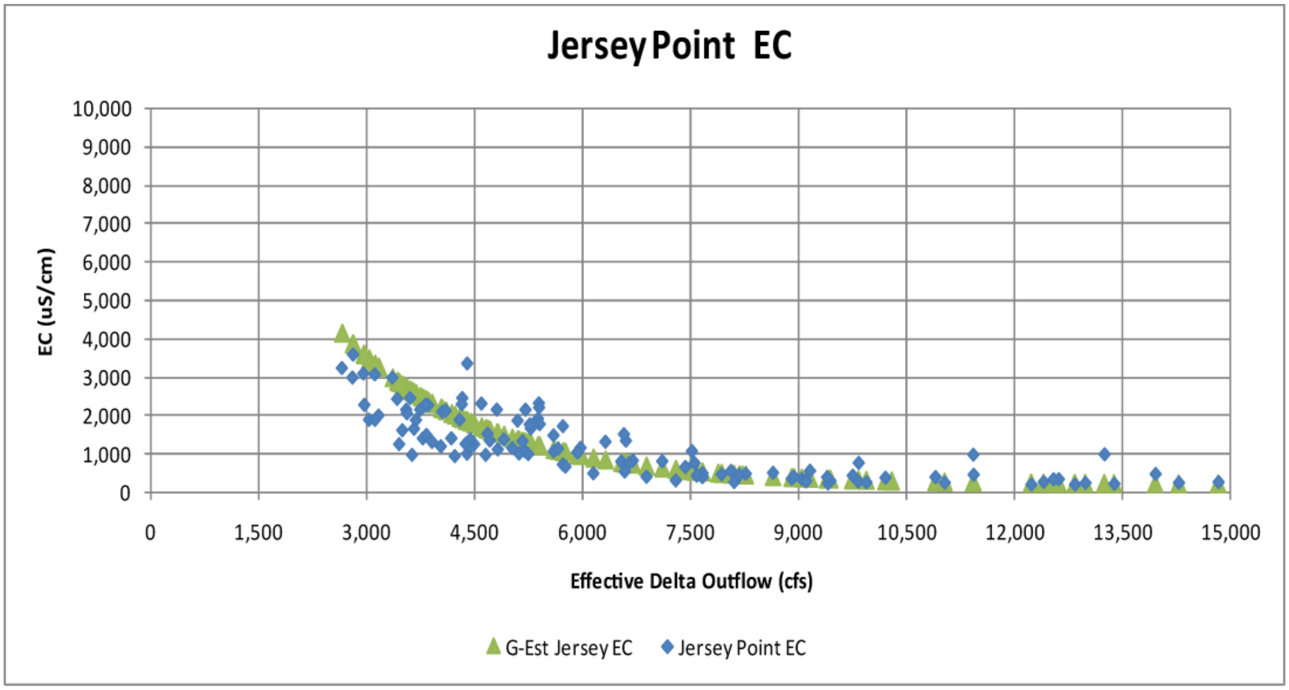
Source: ICF 2010; adapted by AECOM in 2013

Exhibit 3.11-7a Negative Exponential Relationship for Effective Delta Outflow and Salinity (EC)—Historical EC and Estimated EC at Chipps Island (75 km) for 1976–1991



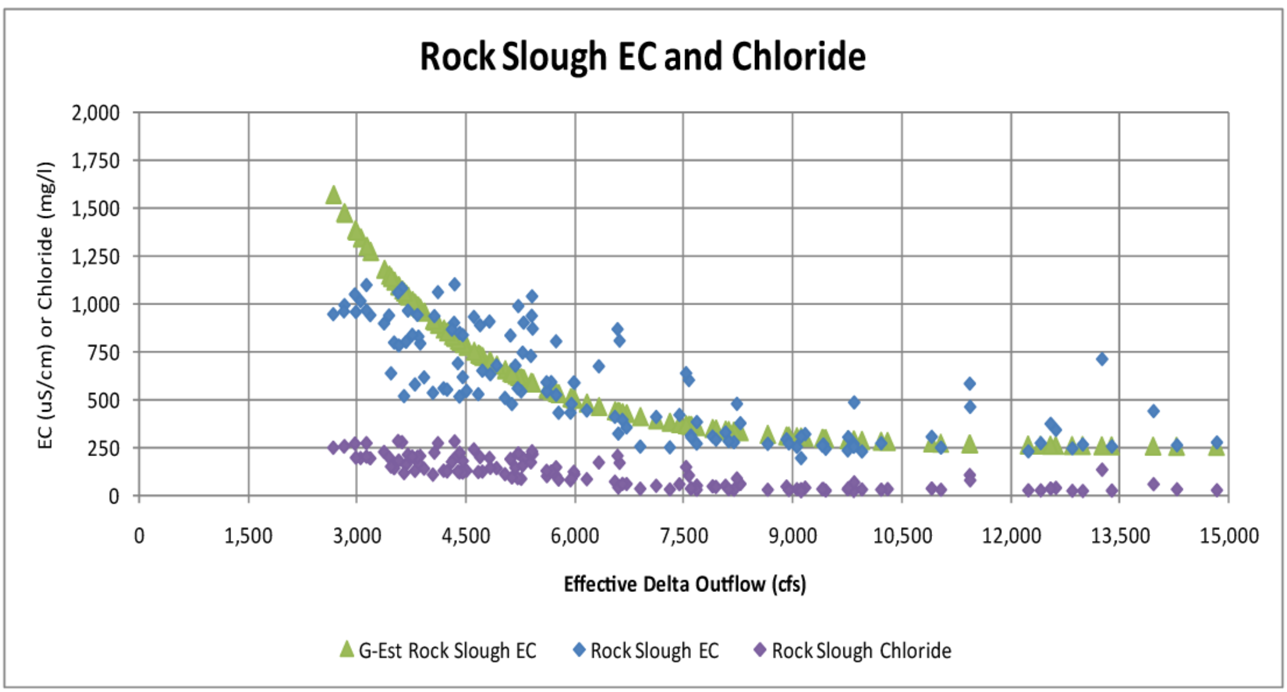
Source: ICF 2010; adapted by AECOM in 2013

Exhibit 3.11-7b Negative Exponential Relationship for Effective Delta Outflow and Salinity (EC)—Historical EC and Estimated EC at Emmaton (km 92) for 1976–1991



Source: ICF 2010; adapted by AECOM in 2013

Exhibit 3.11-7c Negative Exponential Relationship for Effective Delta Outflow and Salinity (EC)—Historical EC and Estimated EC at Jersey Point (km 52) for 1976–1991



Source: ICF 2010; adapted by AECOM in 2013

Exhibit 3.11-7d Negative Exponential Relationship for Effective Delta Outflow and Salinity (EC)—Historical EC and Chloride at Rock Slough with Estimated EC for 1976–1991

3.12 LAND USE

3.12.1 INTRODUCTION

This section describes recent changes to the existing environmental conditions and regulatory framework/ applicable laws, plans, regulations, and policies of the project study area, summarizes the unchanged affected environment, and describes changed environmental effects related to land use, ownership, and planning for the project. A review and update of the 1995 DEIR/EIS land use assessment was incorporated in the 2001 FEIS. Chapter 3I in the 2001 FEIS provided detailed information regarding land uses, ownership, and planning associated with the project and in the Sacramento-San Joaquin Delta (Delta) in general. The land use effects of the project were analyzed most recently in Section 4.8 and Chapter 5 of the 2010 DEIR, which also served as a basis for this analysis. The 1995 DEIR/EIS, 2001 FEIS, and 2010 DEIR are herein incorporated by reference.

The 2001 FEIS concluded that the project alternatives would affect land use on the four project islands, in terms of inconsistency with adopted general plan policies for agricultural lands and inconsistency with the Delta Protection Commission's (DPC's) land use plans and policies.

There have been minor changes in the "Affected Environment" and "Regulatory Framework/Applicable Laws, Regulations, Plans, and Policies" since the 2001 FEIS, but these changes do not alter the conclusions in the 2001 FEIS regarding environmental effects related to land use, ownership, and planning, or change the severity or intensity of environmental effects.

The project would not have any direct effects related to land use, ownership, or planning in the places of use; the effects on land use, if any, associated with the provision of project water to the places of use are addressed in the "Secondary and Cumulative Effects" subsection below and in Chapter 4, "Other Statutory Requirements."

SUMMARY OF CHANGES, NEW CIRCUMSTANCES, AND NEW INFORMATION

Substantial Changes in the Project

Since the 2001 FEIS, there have been no substantial changes to the project resulting in new significant adverse effects or substantial increase in the severity or intensity of effects on land use, ownership, and planning. However, the project no longer includes a proposal to construct new recreation facilities on the Reservoir or Habitat Islands; this change to the project results in a reduction and/or elimination of some the previously identified environmental effects.

New Circumstances

Since the 2001 FEIS was completed, there have been no substantial new circumstances resulting in new significant adverse effects or substantial increase in the severity or intensity of effects on land use, ownership, and planning.

New Information

There is no new information of substantial importance that would result in an increase in the severity or intensity of effects on land use, ownership, or planning. The key sources of new information pertaining to land use that were reviewed or used to prepare this section include:

- Development Title of San Joaquin County, adopted July 1992, published 1995 (updated monthly);
- Contra Costa County General Plan 2005-2020 (Contra Costa County 2005);
- San Joaquin County General Plan 2010 (San Joaquin County 1992); and
- current property ownership on the project islands.

SUMMARY OF ENVIRONMENTAL COMMITMENTS

Environmental commitments are measures incorporated by the project applicant as part of the project, meaning they are proposed as elements of the Proposed Action and are therefore considered in conducting the environmental analysis for each resource area of this SEIS. The purpose of environmental commitments is to reflect and incorporate best practices into the project that avoid, minimize, reduce, or offset potential environmental effects. A complete description of the environmental commitments that have been incorporated into the project since the 2001 FEIS is contained in Chapter 2, "Project Description and Alternatives," of this SEIS.

To ensure continued agricultural production and habitat management and on the habitat islands, the project applicant will record conservation easements over Bouldin Island and Holland Tract lands controlled by Delta Wetlands Properties. The easements will be developed to be consistent with the Draft Compensatory Mitigation Plan (CMP) and will be recorded in San Joaquin County and Contra Costa County, respectively.

3.12.2 AFFECTED ENVIRONMENT

Existing land use conditions are, for the most part, as they were presented in the 2001 FEIS and are herein incorporated by reference. Land uses in areas adjacent to the project islands are discussed briefly in the following section. Revisions or updates to the adopted San Joaquin County Development Title and the Contra Costa County General Plan as they pertain to new (since 2001) land use designations, ordinances, and policies, have been incorporated below. Bacon Island and Bouldin Island are located in San Joaquin County, and Holland Tract and Webb Tract are in Contra Costa County.

ADJACENT LAND USES

Land Uses near Bacon Island

Land on islands surrounding Bacon Island is used primarily for agriculture. Scattered agricultural structures, equipment complexes, and a few rural residences are interspersed throughout the vicinity. San Joaquin County has designated land north, south, and east of Bacon Island on Mandeville Island, Woodward Island, and Lower Jones Tract as Agriculture (AG).

Land Uses near Webb Tract

Webb Tract is bordered by the San Joaquin River to the north and east, False River and the flooded Franks Tract to the south, and Fisherman's Cut to the west. Land use west of Webb Tract on Bradford Island is mainly agriculture with associated farmsteads and structures related to agricultural production. Boating facilities are located on the eastern shoreline of Bradford Island, facing toward Webb Tract. The Contra Costa County General Plan designation for all of Bradford Island is Delta Recreation and Resources.

Franks Tract, south of Webb Tract across False River, is a State Recreation Area. The flooded portion of Franks Tract is designated as Water and the designation for land areas is Parks and Recreation. Franks Tract is used primarily for boating and other water-oriented recreation and has no extensively developed areas.

Land north of Webb Tract across the San Joaquin River is located in Sacramento County. This area has some shoreline development, but most land is in agricultural use with scattered farmsteads and other agriculture-related structures. Land use designations for this area are Recreation and Agricultural Cropland.

Land Uses near Bouldin Island

The Mokelumne River bounds Bouldin Island to the north and west, and Potato Slough bounds the island to the east and south. Land on islands surrounding Bouldin Island is used primarily for agricultural production. Scattered agricultural structures, equipment complexes, and a few rural residences are interspersed throughout the vicinity.

In San Joaquin County, islands surrounding Bouldin Island have been designated Agriculture (AG). Staten and Venice Islands, located north and south of Bouldin Island, respectively, are under Williamson Act Contracts. Andrus and Tyler Islands, west of Bouldin Island, have been designated as Agricultural Cropland by Sacramento County. Most of the parcels on these islands are under Williamson Act Contracts. Most parcels east of Bouldin Island on Terminus and Empire Tracts are also under Williamson Act Contracts.

Land Uses near Holland Tract

Bethel Island northwest of Holland Tract has extensive shoreline development, consisting mainly of boat docks, marinas, single-family residences, and some retail businesses. General plan designations for this developed area are mainly Single-Family Residential High-Density, with some Commercial and Multifamily Residential uses permitted. Similar shoreline land uses exist on Hotchkiss Tract, on the western shore of Sand Mound Slough west of Holland Tract. Inland use of these adjacent islands is primarily for agriculture, with a limited amount of rural residential development.

Franks Tract State Recreation Area is north of Holland Tract. Land uses and designations on Franks Tract are described above.

Land uses south of Holland Tract on Veale and Palm Tracts are generally agricultural with some farmsteads and agricultural structures. Veale Tract is designated as Delta Recreation and Resources with land uses such as agriculture, wildlife habitat, and low-intensity recreational use.

Approximately half of Palm Tract, east of Veale Tract, is designated Delta Recreation and Resources, and this land is under Williamson Act Contract. The remainder of Palm Tract is designated Public/Semi-Public.

LAND USE CONDITIONS ON THE PROJECT ISLANDS

The four project islands are used primarily for agricultural production, with some hunting and fishing recreational uses. In general, conditions remain as they were at the time the 2001 FEIS was prepared. However, there have been some changes in property ownership and in the number of residences, agricultural structures, and occupants on the islands. These changes are presented in the following section.

Bacon Island

Several farmsteads or rural residences are located on the island near the perimeter levees. In total, there are approximately 20 occupants on the island. Agricultural structures and equipment complexes are located in the northern, central, and southern portions of the island. An airstrip for crop dusting flights is located on the eastern portion of the island. Bacon Island, as well as all structures and residences, is entirely owned by the project applicant. Property on Bacon Island is leased out for farming; however, the leases are all short-term and contemplate eventual conversion to water storage. The San Joaquin County zoning designation for Bacon Island is “General Agriculture” with an 80-acre parcel minimum (AG-80). The land use designation for Bacon Island is “General Agriculture” (AG). The land use designation for land along sloughs and rivers surrounding Bacon Island is “Open Space/Resource Conservation.”

Webb Tract

A small number of agricultural structures and equipment complexes are located on the island, mainly near the perimeter levees. A clubhouse and caretaker's trailer are located on high ground at the extreme eastern tip of the island. There are two occupants on Webb Tract. Webb Tract, as well as all structures and residences, is entirely owned by the project applicant. Property on Webb Tract is leased out for farming; however, the leases are all short-term and contemplate eventual conversion to water storage. The Contra Costa County zoning designation for Webb Tract is "Agriculture" (A-2). The land use designation for Webb Tract is "Delta Recreation and Resources."

Bouldin Island

Scattered agricultural structures and equipment complexes are located in the northern, central, and southern portions of the island. Several residences and associated farmstead structures are located north of SR 12. Two residences, one of which is currently occupied, are located south of SR 12 on the eastern side of the island. There are approximately 40 occupants in total on Bouldin Island. On the eastern portion of the island, just south of SR 12, there is an airstrip used by crop-dusting operators. An oil drilling pad is located on the western portion of the island. Bouldin Island is entirely owned by the project applicant. Property on Bouldin Island is leased for farming; however, the leases are all short-term and eventual conversion to habitat management is contemplated. The San Joaquin County zoning designation for Bouldin Island is "General Agriculture" with a 40-acre parcel minimum (AG-40). The land use designation for Bouldin Island is "Agriculture" (AG). The designation for land along sloughs and rivers is "Open Space/Resource Conservation."

Holland Tract

Agricultural structures and equipment complexes are scattered along the southern and western perimeter levees. On-site residences include a trailer located in the northeast portion of the island near the levee bordering Holland Cut and two residences in the western portion of the island. An abandoned hog feeding area is located east of these two residences. This area includes several structures ancillary to hog farming and untilled open space. There are two occupants currently residing on Holland Tract.

Two marinas are located at the southern boundary of Holland Tract on Rock Slough. The Lindquist Landing Marina on the southern boundary features boat docks and other structures ancillary to marina uses. The Holland Riverside Marina, at the southeastern corner of the island, is a large facility with numerous boat docks, covered slips, and ancillary marina uses.

The project applicant owns all land on Holland Tract except several small parcels in the southwestern corner of the island, the two marina parcels along the southeastern perimeter of the island, and the approximately 263-acre Wildlands, Inc. parcel directly north of the Lindquist Landing Marina. Wildlands intends to convert this property to a habitat mitigation bank. The marina parcels, an estimated 857 acres in the southwestern corner of Holland Tract, the Wildlands property, and other small parcels are excluded from Alternatives 1 and 2 (estimated 1,120 acres total). The remaining property on Holland Tract is leased out for grazing; however, the leases are all short-term and eventual conversion to habitat management is contemplated. The Contra Costa County zoning designations for Holland Tract are "General Agricultural District" (A-2) and "Heavy Agricultural District" (A-3). The land use designation for Holland Tract is "Delta Recreation and Resources."

3.12.3 REGULATORY FRAMEWORK/APPLICABLE LAWS, REGULATIONS, PLANS, AND POLICIES

Federal applicable laws and regulations are provided because they are required under NEPA. State applicable laws and regulations are provided for informational purposes and to assist with NEPA review. USACE has considered applicable state, regional, and local plans and ordinances as a part of the environmental review process for this SEIS, where applicable.

FEDERAL

There are no Federal laws, regulations, plans, or policies related to land use that pertain to the Proposed Action or alternatives under consideration.

STATE

1992 Delta Protection Act

Section 29703a of the 1992 Delta Protection Act designates the Delta Primary Zone as an area for protection from intrusion of nonagricultural uses and establishes the DPC. The DPC is a state entity that plans for and guides the conservation and enhancement of the natural resources in the Delta, while sustaining agriculture and meeting increased recreational demand.

In 1995, the DPC adopted its regional plan, *Land Use and Resource Management Plan for the Primary Zone of the Delta* (LURMP), which outlines findings, policies, and recommendations to guide land use and resource management decisions in the Primary Zone of the Delta. The LURMP was updated in 2009 and adopted in February 2010. As stated in the act, the goals of this regional plan are to “protect, maintain and, where possible, enhance and restore the overall quality of the Delta environment, including, but not limited to, agriculture, wildlife habitat, and recreational activities.” All four project islands are located within the Delta Primary Zone.

3.12.4 ANALYSIS METHODOLOGY

Land use effects were assessed based on how construction and operation of the Proposed Action and alternatives under consideration would benefit or adversely affect existing residences and structures, adjacent land uses, and existing land uses. The project alternatives also were evaluated for their consistency with adopted land use designations and policies of the respective county general plans associated with the four project islands and zoning ordinances and DPC regional policies.

SIGNIFICANCE CRITERIA

The basis for determining the significance of effects for this analysis is based on professional standards, project-specific criteria developed by the lead agency to address potential effects unique to the project’s location and elements, and is informed by the criteria contained in the Environmental Checklist in Appendix G of the State CEQA Guidelines. These thresholds encompass the factors taken into account under NEPA to determine the significance of an action in terms of its context and the intensity of its effects. The Proposed Action or alternatives under consideration would have a significant effect on land use if they would do any of the following:

- displace existing residences and structures in areas where replacement housing is unavailable and landowners are not willing sellers;
- be incompatible with existing adjacent land uses; or
- conflict with adopted plans and policies in the project area.

3.12.5 Environmental Consequences and Mitigation Measures

Effects Analysis

Effects on land use resulting from project implementation were described in the 2001 FEIS (Chapter 3I) and are listed below in Table 3.12-1. Where there have been no changes to the effects analysis or conclusions, the 2001 FEIS is incorporated by reference, and the effects conclusions and mitigation measures are briefly summarized.

No-Action Alternative

EFFECT LU-1 Displacement of Residences and Structures on the Project Islands. *No project-related facilities would be constructed, and there would be no displacement of residences or other structures from agricultural activities. No effect would occur.*

None of the facilities associated with the project would be constructed, agricultural operations on the project islands would continue, and there would be **no effect** related to displacement of residences or structures.

EFFECT LU-2 Displacement of Property Owners on the Project Islands. *No project-related facilities would be constructed, and thus there would be no displacement of occupants on the project islands. No effect would occur.*

None of the facilities associated with the project would be constructed, agricultural operations on the project islands would continue, and there would be **no effect** related to occupants on the project islands.

EFFECT LU-3 Conflicts with Adjacent Land Uses. *No project-related facilities would be constructed, and thus there would be no conflicts with adjacent land uses. No effect would occur.*

None of the facilities associated with the project would be constructed, agricultural operations on the project islands would continue, and there would be **no effect** related conflicts with adjacent land uses.

EFFECT LU-4 Consistency with Zoning and General Plan Designations and Delta Protection Commission Land Use Plan Principles. *No project-related facilities would be constructed, and thus there would be no inconsistency with zoning and general plan designations or DPC land use plan principles. No effect would occur.*

None of the facilities associated with the project would be constructed, agricultural operations on the project islands would continue, and there would be **no effect** related to consistency with land use and zoning designations.

Alternative 1 and Alternative 2 (Proposed Action)

The effects analysis and mitigation measures for Alternatives 1 and 2 are the same; therefore, they are described together under this heading.

EFFECT LU-1 Displacement of Residences and Structures on the Project Islands. *Land on all four project islands is held under short-term farm leases that contemplate eventual conversation to water storage. This effect is less than significant.*

Property on the Reservoir Islands (Bacon Island and Webb Tract) is leased out for farming, but these leases are short-term and contemplate eventual conversion to water storage. Implementation of Alternatives 1 and 2 would result in continuation of agriculture and new habitat management activities on the Habitat Islands, and therefore would not require removal or relocation of existing structures on Bouldin Island or Holland Tract. Therefore, the effect related to displacement of residences, structures, or other property on the reservoir islands would be **less than significant**.

Mitigation Measure: No mitigation is required.

EFFECT LU-2 **Displacement of Property Owners on the Project Islands.** *Housing opportunities in the local area are considered sufficient for those affected to be housed. This effect is less than significant.*

The project applicant owns all of the property on the Reservoir and Habitat Islands that would be included as part of the project under Alternatives 1 and 2. Occupants currently residing on the four project islands would need to relocate; however, housing opportunities in the local area are considered sufficient for those affected to be housed. Therefore, this effect is **less than significant**.

Mitigation Measure: No mitigation is required.

EFFECT LU-3 **Conflicts with Adjacent Land Uses.** *Project implementation would not result in substantial conflicts with or create nuisances that could affect or impair adjacent land uses. This effect is less than significant.*

Bacon Island and Webb Tract

As discussed in the 2001 FEIS, storage of water on Bacon Island and Webb Tract would not adversely affect adjacent land uses because the islands are buffered by levees and surrounding waterways (see Section 3.9, "Floodplain Management," for more detail on levee structure). Thus, implementation of Alternatives 1 or 2 would not create nuisances that could affect or impair off-site agricultural or nonagricultural land uses.

Implementation of Alternatives 1 or 2, without appropriate remedial measures, could result in flooding of adjacent lands from seepage from Bacon Island onto surrounding islands. However, as discussed in Chapter 2, "Project Description and Alternatives," project implementation includes seepage control measures as part of Alternatives 1 and 2.

Bouldin Island and Holland Tract

Habitat management on Bouldin Island and Holland Tract would not adversely affect adjacent land uses because the islands are buffered by levees and surrounding waterways. Thus, Alternatives 1 and 2 would not create nuisances that could affect or impair adjacent off-site agricultural or urban land uses.

For the reasons stated above, effects related to conflicts with adjacent land uses would be **less than significant**.

Mitigation measure: No mitigation is required.

EFFECT LU-4 **Consistency with Zoning and General Plan Designations and Delta Protection Commission Land Use Plan Principles.** *While certain aspects of the project would be consistent with existing land use and zoning designations, the project would be inconsistent with Contra Costa County and DPC agricultural principles to protect and encourage agricultural uses in the Delta. This effect is significant.*

Consistent Uses on the Project Islands

Bacon Island

In an AG zone, water storage is a permitted land use with a use permit. San Joaquin County requires a use permit for water storage projects of greater than 6 feet in depth, for storage of 30 days or more in any calendar year, on 500 acres or more of agricultural land. A use permit would be obtained if this ordinance applies to the project.

Webb Tract

Water storage on Webb Tract would require rezoning to P-1, Planned Unit (Roche, pers. comm., 2009) and would require a development plan. According to Division 84, Chapter 84-66 of the Contra Costa County Code of Ordinances, "The P-1 district is intended to allow diversification in the relationship of various uses, buildings, structures, lot sizes and open space while insuring substantial compliance with the general plan and the intent of the county code in requiring adequate standards necessary to satisfy the requirements of the public health, safety and general welfare." P-1 zoning would be consistent with the general plan and with the uses proposed under Alternatives 1 and 2 (Roche, pers. comm., 2009).

As discussed in the 2001 FEIS, Alternatives 1 and 2 would be consistent with the Contra Costa County General Plan Delta Recreation and Resource land use designation, which allows for wildlife habitat and limited recreation.

Bouldin Island

As discussed in the 2001 FEIS, Alternatives 1 and 2 are considered consistent with the San Joaquin County zoning and general plan designations because the project retains open space values and encourages the multiple uses of open space.

Holland Tract

As discussed in the 2001 FEIS, the proposed habitat management component of Alternatives 1 and 2 are consistent with the Contra Costa County General Plan Delta Recreation and Resources land use designation and with the agricultural zoning on Holland Tract because the project would provide uses compatible with agriculture.

Inconsistent Uses on the Project Islands

Implementation of Alternatives 1 or 2 would convert a total of approximately 6,534 acres of farmland (Prime and Unique Farmland, and Farmland of Statewide and Local Importance) on Webb and Holland Tracts (i.e., the Habitat Islands) to water storage and habitat uses, respectively. This conversion, and subsequent loss of agricultural production, is not consistent with Contra Costa County's agricultural principles to maintain and promote a healthy and competitive agricultural economy or to protect and preserve areas suited to prime agricultural production. Although the inherent agricultural productivity of the islands would not be substantially changed by the use of agricultural land for water storage or habitat management, the proposed use is not consistent with these general plan principles.

Removing land from agricultural production is inconsistent with the DPC's agricultural policy to support and encourage agriculture in the Delta as a key element in the state's economy. It is also partially inconsistent with DPC's agricultural policy to protect agricultural areas from inundation as the project would flood agricultural land in the Delta during periods of storage; however, the project also would provide a net benefit to the overall flood protection in the Delta. In addition, because a substantial number of acres of prime farmland would be converted to non-agricultural use, it is inconsistent with the DPC's agricultural policy that indicates that conversion of land to non-agriculture-oriented uses should occur where productivity and agricultural values are lowest.

Conclusion

While certain aspects of the project would be consistent with existing land use and zoning designations, use permits would be required, and the project would be inconsistent with Contra Costa County and DPC agricultural principles to protect and encourage agricultural uses in the Delta. This effect is **significant**.

Mitigation measure: No feasible mitigation measures are available.

As described in Chapter 2, "Project Description and Alternatives" the project applicant has entered into an environmental commitment to place agricultural conservation easements on Bouldin Island and Holland Tract, which would help to reduce the severity of this adverse effect. However, no feasible mitigation is available to fully reduce this effect to a less-than-significant level. Therefore, this effect is **significant and unavoidable**.

Alternative 3

EFFECT LU-1 Displacement of Residences and Structures on the Project Islands. *Land on all four project islands is held under short-term farm leases that contemplate eventual conversation to water storage. This effect is less than significant.*

Implementation of Alternative 3 would convert on-site agricultural land uses to water storage operations on all four project islands. This change would require removal or relocation of existing on-site structures and farmsteads. The proposed CMP would not be implemented under Alternative 3, and therefore removal or relocation of existing structures on Holland Tract would be required. The affected landowners on Holland Tract, as well as the other project islands, would be compensated for their property as willing sellers. Therefore, this effect would be less than significant.

Mitigation Measure: No mitigation is required.

EFFECT LU-2 Displacement of Property Owners on the Project Islands. *Housing opportunities in the local area are considered sufficient for those affected to be housed; and the affected landowners on Bouldin Island and Holland Tract have been or would be compensated for their property as willing sellers. This effect is less than significant.*

Occupants currently residing on the four project islands would need to relocate; however, housing opportunities in the local area are considered sufficient for those affected to be housed. The affected landowners on Bouldin Island and Holland Tract have been or would be compensated for their property as willing sellers. Therefore, this effect is **less than significant**.

Mitigation Measure: No mitigation is required.

EFFECT LU-3 Conflicts with Adjacent Land Uses. *Project implementation would not result in substantial conflicts with or create nuisances that could affect or impair adjacent land uses. This effect is less than significant.*

As discussed in the 2001 FEIS, storage of water on the four project islands under Alternative 3 would not adversely affect adjacent land uses because the islands are buffered by levees and surrounding waterways (see Section 3.9, "Floodplain Management," for more detail on levee structure). Thus, implementation of Alternatives 1 or 2 would not create nuisances that could affect or impair adjacent off-site agricultural or urban land uses.

Implementation of Alternative 3, without appropriate remedial measures, could result in flooding of adjacent lands from seepage from Bacon Island onto surrounding islands. However, as discussed in Chapter 2, "Project Description and Alternatives," project implementation includes seepage control measures as part of Alternative 3.

Habitat management activities associated with the North Bouldin Habitat Area would not adversely affect adjacent land uses because the island is buffered by levees and surrounding waterways.
For the reasons stated above, effects related to conflicts with adjacent land uses would be **less than significant**.

Mitigation Measure: No mitigation is required.

EFFECT LU-4 **Consistency with Zoning and General Plan Designations and Delta Protection Commission Land Use Plan Principles.** *While certain aspects of the project would be consistent with existing land use and zoning designations, the project would be inconsistent with Contra Costa County and DPC agricultural principles to protect and encourage agricultural uses in the Delta. This effect is significant.*

Consistent Uses on the Project Islands

As discussed in the 2001 FEIS, the project's consistency with zoning and general plan designations under Alternative 3 would be the same as previously described above for Alternatives 1 and 2. Water storage on Holland Tract and water storage and habitat management on Bouldin Island would not adversely affect adjacent land uses for the same reasons as described above for Bacon Island and Webb Tract.

Inconsistent Uses on the Project Islands

Implementation of Alternative 3 would convert approximately 9,588 acres of farmland (Prime and Unique Farmland, and Farmland of Statewide and Local Importance) on Webb and Holland Tracts (i.e., the Habitat Islands) to water storage use. Effects due to agricultural land conversion under Alternative 3 would be greater than under Alternatives 1 or 2 because under Alternative 3, no crops would be planted on Holland Tract or Bouldin Island, although as part of the project's environmental commitments (Chapter 2, "Project Description and Alternatives"), agricultural conservation easements would be placed on Bouldin Island and Holland Tract.

Agricultural land conversion is not consistent with the Contra Costa County General Plan or the DPC's agricultural principles to preserve agricultural lands for agricultural production and promote a competitive agricultural economy. Although the inherent agricultural productivity of the islands would not be substantially changed by use of agricultural land for water storage, the proposed use is not consistent with these general plan principles.

Conclusion

While certain aspects of the project would be consistent with existing land use and zoning designations, use permits would be required, and the project would be inconsistent with Contra Costa County and DPC agricultural principles to protect and encourage agricultural uses in the Delta. Therefore, this effect is **significant.**

Mitigation measure: No feasible mitigation measures are available.

As described in Chapter 2, "Project Description and Alternatives" the project applicant has entered into an environmental commitment to place agricultural conservation easements on Bouldin Island and Holland Tract, which would help to reduce the severity of this adverse effect. However, no feasible mitigation is available to fully reduce this effect to a less-than-significant level. Therefore, this effect is **significant and unavoidable**.

3.12.6 SECONDARY AND CUMULATIVE EFFECTS

Secondary and cumulative effects related to land use, ownership, and planning from implementing the project were described in the 2001 FEIS (Chapter 3I) and the 2010 DEIR (Chapter 5). The 2001 FEIS and 2010 DEIR are herein incorporated by reference, and the effect conclusions and mitigation measures, along with any changes, are summarized briefly below and shown in Table 3.12-2.

Table 3.12-1
Comparison of Delta Wetlands Project 2001 FEIS and this SEIS Effects and Mitigation Measures for Land Use

2001 FEIS Effects and Mitigation Measures	SEIS Effects and Mitigation Measure
Alternatives 1 and 2 (Proposed Action)	
Impact I-1: Displacement of Residences and Structures on Reservoir Islands (LTS) **Mitigation:** No mitigation is required.	**Effect LU-1:** Displacement of Residences and Structures on the Project Islands (LTS) **Mitigation:** No mitigation is required. No change.
Impact I-2: Displacement of Property Owners on Habitat Islands (LTS) **Mitigation:** No mitigation is required.	**Effect LU-2:** Displacement of Property Owners on the Project Islands (LTS) **Mitigation:** No mitigation is required. No change.
Discussed in text but not numbered.	**Effect LU-3:** Conflicts with Adjacent Land Uses (LTS) **Mitigation:** No mitigation is required. No change.
Impact I-3: Inconsistency with Contra Costa County General Plan Policy for Agricultural Lands and Delta Protection Commission Land Use Plan Principles for Agriculture and Recreation (SU) **Mitigation:** No mitigation is available to reduce this impact to a less-than-significant level.	**Effect LU-4:** Consistency with Zoning and General Plan Designations and Delta Protection Commission Land Use Plan Principles (SU) **Mitigation:** Portions of this effect were discussed in the 2001 FEIS text, but were not numbered. The analysis and conclusions have not changed. No mitigation is available to fully reduce this effect to a less-than-significant level; however, changes have been incorporated into the project to reduce the severity of the effect.
Alternative 3	
Impact I-5: Displacement of Residences and Structures on Reservoir Islands (LTS) **Mitigation:** No mitigation is required.	**Effect LU-1:** Displacement of Residences and Structures on the Project Islands (LTS) **Mitigation:** No mitigation is required. No change.
Impact previously dealt only with property owners on the Habitat Islands. Since the Habitat Islands would not occur under Alternative 3, this was not evaluated as an impact.	**Effect LU-2:** Displacement of Property Owners on the Project Islands (LTS) **Mitigation:** No mitigation is required. No change.
Discussed in text but not numbered.	**Effect LU-3:** Conflicts with Adjacent Land Uses (LTS) **Mitigation:** No mitigation is required. No change.
Impact I-6: Inconsistency with Contra Costa County General Plan Policy for Agricultural Lands and Delta Protection Commission Land Use Plan Principles for Agriculture and Recreation (SU)	**Effect LU-4:** Consistency with Zoning and General Plan Designations and Delta Protection Commission Land Use Plan Principles (SU) **Mitigation:** Portions of this effect were discussed in the 2001 FEIS text, but were not numbered. The analysis and conclusions have not changed. No mitigation is available to fully reduce this effect to a less-than-significant level; however, changes have been incorporated into the project to reduce the severity of the effect.

Notes: Shading denotes changes in the effect, significance conclusion, or mitigation measure from the 2001 FEIS. SU = Significant and unavoidable; LTS = Less than significant

Sources: ICF 2010:4.8-2 through 4.8-3 and AECOM 2013

Changes in Housing Supply as a Result of Displacement of Residences

As discussed in the 2001 FEIS, the Delta Wetlands project would result in removal of existing homes on Bacon Island, Webb Tract, and Bouldin Island. Approximately 75 residential housing accommodations, of various types, would be removed. The affected landowners have been or would be compensated for their property as willing sellers. Housing opportunities in the local area are considered sufficient for those affected to be housed; and the need for the additional residential accommodations is not large enough, when considered in combination with the related projects, to result in a cumulatively significant effect related to housing supply.

Compatibility with Adjacent Land Uses

As discussed in the 2001 FEIS, the Delta Wetlands project would not result in an incompatibility with adjacent land uses because the islands are buffered by levees and surrounding waterways, and because project implementation includes levee seepage control measures. Although implementation of some of the related projects may themselves result in an incompatibility with adjacent land uses, the Delta Wetlands project would not result in a cumulatively considerable contribution.

Consistency with Zoning and General Plan Designations and Delta Protection Commission Land Use Plan Principles

As discussed in the 2001 FEIS, the Delta Wetlands project, in conjunction with other projects that convert agricultural land to other uses, would not be consistent with Contra Costa County General Plan or DPC's principles that promote the retention and production of agricultural land. The related projects considered in this cumulative analysis that would entail conversion of agricultural land to other uses in the Delta and in Contra Costa County, would also not be consistent with Contra Costa County General Plan or DPC's agricultural principles. Therefore, the Delta Wetlands Project, when considered in combination with the related projects where agricultural land conversion would occur in the Delta, would result in a cumulatively considerable contribution to this cumulatively significant effect. No feasible mitigation measures are available to reduce this effect to a less-than-significant level. Therefore, this effect is cumulatively significant and unavoidable.

Table 3.12-2
Comparison of Secondary and Cumulative Land Use Effects between the 2001 FEIS and this SEIS

2001 FEIS Cumulative Effects and Mitigation Measures	SEIS Cumulative Effects and Mitigation Measures
Discussed in text but not numbered.	Changes in Housing Supply as a Result of Displacement of Residences (NCC) **Mitigation:** No mitigation is required. No change.
Discussed in text but not numbered.	Compatibility with Adjacent Land Uses (NCC) **Mitigation:** No mitigation is required. No change.
Discussed in text but not numbered.	Consistency with Zoning and General Plan Designations and Delta Protection Commission Land Use Plan Principles (CCU) **Mitigation:** No mitigation is available to reduce this effect to a less-than-significant level. No change.

Notes: CCU = Cumulatively Considerable and Unavoidable; NCC = Not cumulatively considerable

Sources: ICF 2001:Section 3I and AECOM 2013

3.13 NOISE

3.13.1 INTRODUCTION

This section describes the existing environmental conditions and regulatory framework of the project study area, summarizes the affected environment, and describes environmental effects of the project regarding noise. The effects of noise were not discussed in the 2001 FEIS. They were, however, discussed in the 2010 DEIR (Section 4.15), which is herein incorporated by reference.

The project would not have any direct adverse effects on noise in the places of use; the effects on noise, if any, associated with the provision of project water to the places of use are addressed in the "Secondary and Cumulative Effects" subsection below and in Chapter 4, "Other Statutory Requirements."

SUMMARY OF ENVIRONMENTAL COMMITMENTS

Environmental commitments are measures incorporated by the project applicant as part of the project, meaning they are proposed as elements of the Proposed Action and are therefore considered in conducting the environmental analysis for each resource area of this SEIS. The purpose of environmental commitments is to reflect and incorporate best practices into the project that avoid, minimize, reduce, or offset potential adverse environmental effects. A complete description of the environmental commitments that have been incorporated into the project since the 2001 FEIS is contained in Chapter 2, "Project Description and Alternatives," of this SEIS. There are no environmental commitments that would affect the analysis or conclusions related to noise.

3.13.2 AFFECTED ENVIRONMENT

INTRODUCTION TO NOISE

Sound is mechanical energy transmitted by pressure waves in a compressible medium such as air. Noise can be defined as unwanted sound. Sound is characterized by various parameters that include the rate of oscillation of sound waves (frequency), the speed of propagation, and the pressure level or energy content (amplitude). In particular, the sound pressure level is the most common descriptor used to characterize the loudness of an ambient sound level. The decibel (dB) scale is used to quantify sound intensity. Because sound pressure can vary enormously within the range of human hearing, the logarithmic dB scale used to measure and control sound intensity numbers at a convenient and manageable level.

The human ear is not equally sensitive to all frequencies in the entire spectrum, so noise measurements are weighted more heavily for frequencies to which humans are sensitive in a process called *A-weighting* (dBA). Because humans are less sensitive to low frequency sound than to high frequency sound, dBA sound levels de-emphasize low frequency sound energy to represent better how humans hear. Table 3.13-1 summarizes typical dBA sound levels (based on research conducted by the California Department of Transportation 1998).

Different types of measurements are used to characterize the time-varying nature of sound. These measurements include the equivalent sound level (L_{eq}), the minimum and maximum sound levels (L_{min} and L_{max}), percentile-exceeded sound levels (L_{xx}), the day-night sound level (L_{dn}), and the community noise equivalent level (CNEL). Below are brief definitions of these measurements and other terminology used in this section:
Decibel (dB). A unitless measure of sound on a logarithmic scale that indicates the squared ratio of sound pressure amplitude to a reference sound pressure amplitude. The reference pressure is 20 micro-pascals.

A-Weighted Decibel (dBA). An overall frequency-weighted sound level in decibels that approximates the frequency response of the human ear.

Table 3.13-1 Typical A-Weighted Sound Levels		
Common Outdoor Activities	Noise Level (dBA)	Common Indoor Activities
	110	Rock band
Jet flyover at 1,000 feet		
	100	
Gas lawnmower at 3 feet		
	90	
Diesel truck at 50 feet at 50 mph		Food blender at 3 feet
	80	Garbage disposal at 3 feet
Noisy urban area, daytime		
Gas lawnmower at 100 feet	70	Vacuum cleaner at 10 feet
Commercial area		Normal speech at 3 feet
Heavy traffic at 300 feet	60	
		Large business office
Quiet urban, daytime	50	Dishwasher in next room
Quiet urban, nighttime	40	Theater, large conference room (background)
Quiet suburban, nighttime		
	30	Library
Quiet rural, nighttime		Bedroom at night, concert hall (background)
	20	
		Broadcast/recording studio
	10	
Lowest Threshold of Human Hearing	0	Lowest Threshold of Human Hearing
Source: ICF 2010:4.15-7; adapted by AECOM in 2013		

Equivalent Sound Level (L_{eq}). The average of sound energy occurring over a specified period, typically one hour, in terms of a single numerical value. In effect, L_{eq} is the steady-state sound level that, in a stated period, would contain the same acoustical energy as the time-varying sound that actually occurs during the same period. In essence, it is an averaged sound level over a specific time period that in which the sound level “peaks” and “valleys” have been removed.

Exceedance Sound Level (L_{XX}). The sound level exceeded XX% of the time during a sound-level measurement period or duration. For example L90 is the sound level exceeded 90% of the time and L10 is the sound level exceeded 10% of the time. L90 typically is considered to represent the ambient noise level.

Maximum and Minimum Sound Levels (L_{max} and L_{min}). The maximum or minimum sound level measured during a measurement period.

Day-Night Level (L_{dn}). The energy average of the A-weighted sound levels occurring during a 24-hour period, with 10 dBA added to the A-weighted sound levels occurring during the period from 10 p.m. to 7 a.m. (nighttime) to take into account the greater annoyance of nighttime noises.

Community Noise Equivalent Level (CNEL). The energy average of the A-weighted sound levels occurring during a 24-hour period with 5 dBA added to the A-weighted sound levels occurring during the period from 7 p.m. to 10 p.m. (evening hours) and 10 dBA added to the A-weighted sound levels occurring during the period from 10 p.m. to 7 a.m. (nighttime hours).

L_{dn} and CNEL values rarely differ by more than 1 dBA. As a matter of practice, L_{dn} and CNEL values are considered to be equivalent and are treated as such in this assessment. In general, human sound perception is such that a change in sound level of 3 dBA is just noticeable, a change of at least 5 dBA is required before any noticeable change in human response would be expected, and a change of 10 dBA is perceived as doubling or halving sound level.

For a point source such as a stationary compressor, sound attenuates based on geometry at rate of 6 dBA per doubling of distance. For a line source such as free-flowing traffic on a freeway, sound attenuates at a rate of 3 dBA per doubling of distance. Atmospheric conditions such as wind, temperature gradients, and humidity can change how sound propagates over distance and can affect the level of sound received at a given location. The degree to which the ground surface absorbs acoustical energy also affects sound propagation. Sound that travels over an acoustically absorptive surface such as grass attenuates at a greater rate than sound that travels over a hard surface such as pavement. The increased attenuation is typically in the range of 1 to 2 dBA per doubling of distance. Barriers such as buildings and topography that block the line of sight between a source and receiver also increase the attenuation of sound over distance.

Auditory and nonauditory effects can result from excessive or chronic exposure to elevated noise levels. Auditory effects of noise on people can include temporary or permanent hearing loss. Nonauditory effects of exposure to elevated noise levels consist of sleep disturbance, speech interference, and physiological effects, such as annoyance. Land use compatibility standards for noise typically are based on research related to these auditory effects.

EXISTING NOISE-SENSITIVE LAND USES AND NOISE LEVELS

Noise-sensitive land uses are those locations where noise can interfere with primary activities. These uses include places where people sleep, such as residences and hospitals. Other noise-sensitive uses are schools, libraries, places of worship, and areas of recreation during hours of normal human use.

Noise-sensitive land uses in the project vicinity are primarily residential. Residences are located to the west of Holland Tract on Hotchkiss Tract and to the northwest of Holland Tract on Bethel Island, both in Contra Costa County; to the southwest of Bacon Island in the Town of Discovery Bay (Contra Costa County); and to the east of Bouldin Island in the Community of Terminous (San Joaquin County). Additionally, several lodging areas or mobile home parks exist north of Webb Tract and west of Bouldin Island in Sacramento County. The nearest noise-sensitive land uses to the two proposed pump stations are residences located on Bethel Island (in Contra Costa County), approximately 2.5 miles from the proposed pump station on Webb Tract. Primary noise sources in the project vicinity are agricultural operations, recreational land uses such as boating and hunting, vehicular travel on local roads and highways, and occasional aircraft flyovers.

Population density and ambient noise levels tend to be closely correlated. Areas that are not urbanized are relatively quiet, while more urbanized areas are subjected to higher noise levels from roadway traffic, industrial activities, and other human activities. Table 3.13-2 summarizes typical ambient noise level as related to population density (based on research conducted by Hoover and Keith 2008).

Table 3.13-2
Population Density and Associated Ambient Noise Levels

Population Density	Ambient Noise Level (dBA, L_{dn})
Rural	40–50
Small town or quiet suburban residential	50
Normal suburban residential	55
Urban residential	60
Noisy urban residential	65
Very noisy urban residential	70
Downtown, major metropolis	75–80
Adjoining freeway or near a major airport	80–90

Notes: dBA = A-weighted decibel; L_{dn} = day-night level
Source: ICF 2010:4.15-10; adapted by AECOM in 2013

As land use classifications and densities vary somewhat throughout the project vicinity, so does the existing noise environment. Existing noise levels generally are relatively low in rural/suburban areas (i.e., 40–55 L_{dn}), such as those areas surrounding the project.

3.13.3 Regulatory Framework/Applicable Laws, Regulations, Plans, and Policies

Federal applicable laws and regulations are provided because they are required under NEPA. State applicable laws and regulations are provided for informational purposes and to assist with NEPA review. USACE has considered applicable state, regional, and local plans and ordinances as a part of the environmental review process for this SEIS, where applicable.

Federal

There are no Federal laws, regulations, plans, or policies related to noise that would apply to the Proposed Action or the alternatives under consideration.

State

There are no state laws, regulations, plans, or policies related to noise that would apply to the Proposed Action or the alternatives under consideration.

Local

Bacon and Bouldin Islands are located in San Joaquin County and Webb and Holland Tracts are located in Contra Costa County. The noise elements of the San Joaquin and Contra Costa County General Plans form the basis of the thresholds of significance for this noise analysis; therefore, they are discussed below.

Contra Costa County General Plan Noise Element

The Contra Costa County General Plan (Contra Costa County 2005 [reprinted 2010]) Noise Element establishes acceptable levels of community noise exposure for its noise-sensitive land uses, including a "normally acceptable" standard day-night noise level/community noise equivalent level (Ldn/CNEL) of 60 dBA for residential uses. Contra Costa County has not established maximum allowable noise level standards for stationary noise sources (such as pumps). Noise from construction activities in Contra Costa County is considered exempt from applicable standards during daytime hours, although the county has not defined "daytime" or "normal work hours" for construction noise. Instead, the county uses project-specific conditions of approval to regulate construction noise levels for projects that require county approvals.

Policies contained in the Contra Costa County Noise Element that pertain to the project are listed below:

- **Policy 11-7:** Public projects shall be designed and constructed to minimize long-term noise impacts on existing residents.

- **Policy 11-8:** Construction activities shall be concentrated during the hours of the day that are not noise-sensitive for adjacent land uses and should be commissioned to occur during normal work hours of the day to provide relative quiet during the more sensitive evening and early morning periods.

Noise Ordinance and General Plan Noise Element

The San Joaquin County Noise Ordinance is the primary enforcement tool for the operation of locally regulated noise sources, such as construction activity, and is set forth in Title 9, Section 9-1025.9 of the San Joaquin County Code. Table 3.13-3 summarizes maximum allowable noise level standards for sensitive land uses affected by stationary sources (i.e., nontransportation sources). Noise associated with construction, provided that such activities do not take place before 6 a.m. or after 9 p.m. on any day, is exempted from the provisions of the county noise ordinance.

Table 3.13-3
San Joaquin County Maximum Allowable Noise Exposure—Stationary Sources

	Outdoor Activity Areas	
Population Density	Daytime (7 a.m. to 10 p.m.)	Nighttime (10 p.m. to 7 a.m.)
Hourly equivalent sound level (L_{eq}), dB	50	45
Maximum sound level (L_{max}), dB	70	65

Notes: dB = decibels
Each of the noise level standards specified shall be reduced by 5 dB for impulsive noise, single tone noise, or noise consisting primarily of speech or music.
Source: ICF 2010:4.15-4; adapted by AECOM in 2013

Policies contained in the San Joaquin County General Plan (San Joaquin County 1992) Noise Element that pertain to the project are listed below:

- **Policy 1c:** The hourly equivalent sound level from stationary sources shall be 50 decibels (dB) during the daytime and 45 dB during the nighttime for outdoor activity areas for residential development; transient lodging, hospitals, nursing homes, and similar health-related facilities; churches, meeting halls, and similar community assembly facilities; office buildings; schools; libraries; museums; and day-care centers.

- **Policy 1d:** The maximum sound level from stationary noise sources shall be 70 dB during the daytime and 65 dB during the nighttime for outdoor activity areas for residential development; transient lodging, hospitals, nursing homes, and similar health-related facilities; churches, meeting halls, and similar community assembly facilities; office buildings; schools; libraries; museums; and day-care centers.

3.13.4 ANALYSIS METHODOLOGY

Effects related to noise were evaluated by comparing the projected construction-related and operational noise levels with San Joaquin and Contra Costa County noise standards. Noise prediction modeling methods as recommended by the Federal Transit Administration (for stationary equipment) (U.S. Department of Transportation 2006), were also used in the analysis.

SIGNIFICANCE CRITERIA

The basis for determining the significance of effects for this analysis is based on professional standards, project-specific criteria developed by the lead agency to address potential effects unique to the project's location and elements, and is informed by the criteria contained in the Environmental Checklist in Appendix G of the State CEQA Guidelines. These thresholds encompass the factors taken into account under NEPA to determine the significance of an action in terms of its context and the intensity of its effects. The Proposed Action or alternatives under consideration would have a significant, adverse effect on noise if they would do any of the following:

- construction activity occurs during the more noise-sensitive nighttime hours between 8 p.m. and 7 a.m.;
- operation of the proposed pump stations results in exterior noise levels in excess of L_{eq} 40 dBA during nighttime hours or 45 dBA during daytime hours (as measured on the receiving noise-sensitive property line), per the San Joaquin County noise standards for stationary noise sources (with a 5 dBA penalty applied for simple tone noise sources). Adherence to this criterion also would ensure compliance with the Contra Costa County guideline of L_{dn}/CENL 60 dBA for residential uses; or
- ongoing maintenance and conservation activities would unreasonably disturb noise-sensitive land uses.

3.13.5 ENVIRONMENTAL CONSEQUENCES AND MITIGATION MEASURES

EFFECTS ANALYSIS

Effects on noise resulting from implementation of the project were not previously described in the 2001 FEIS. The effects conclusions and mitigation measures are summarized in Table 3.13-4.

No-Action Alternative

EFFECT NOI-1 Exposure of Sensitive Receptors to Construction-Related Noise and Groundborne Vibration. *Because the project would not be implemented, there would no exposure of sensitive receptors to construction-related noise or groundborne vibration. No effect would occur.*

Because the proposed water storage facilities and levee improvements would not be implemented, the No-Action Alternative would not involve any construction activities that could exposure sensitive receptors to noise levels above county standards. **No effect** would occur.

EFFECT NOI-2 Exposure of Sensitive Receptors to Operational Traffic and Recreation Noise. *Operational noise under the No-Action Alternative would not result in substantial changes in the noise levels. This effect is less than significant.*

Operation of the No-Action Alternative would include an increase in agricultural activity and hunting uses compared to existing conditions. Table 3.17-8 in Section 3.17, "Traffic and Transportation," summarizes peak-hour traffic volumes on roadways in the project study area that would be generated by the No-Action Alternative. Tables 3.17-9 and 3.17-10 summarize the future no-project (i.e., if the project is not implemented and the intensified agricultural activities associated with the No-Action Alternative do not occur) peak-hour traffic volumes. Based on the data in these tables, it is anticipated that traffic volumes under the No-Action Alternative would increase by 19% on Bacon Island Road at the Bacon Island Road Bridge and 27% on Jersey Island Road north of Cypress Road. This would equate to a noise increase of less than 1 dB on Bacon Island Road and on Jersey Island Road. As previously discussed in the "Affected Environment" subsection, in general, human sound perception is such that a change in sound level of 3 dBA is just noticeable, while a change of at least 5 dBA is required before any noticeable change in human response would be expected. Therefore, the increase in traffic noise levels attributable to the No-Action Alternative along these roadway segments would be barely perceptible and would not substantially change from existing conditions. This effect is less than significant.

Because the proposed water facilities and Compensatory Mitigation Plan (CMP) would not be implemented, no noise would be generated from water pump stations, water facility maintenance activities, or habitat conservation activities. Because the No-Action Alternative would entail more intensive agricultural uses, additional noise would be generated from agricultural activity; however, this increase would not be substantial compared to existing conditions. This effect is less than significant.

Operation of the No-Action Alternative would result in increases in hunter use-days on the project islands attributable to the proposed intensive for-fee hunting program. However, these increases are not anticipated to result in any increases in the exposure of noise-sensitive receptors to noise from hunting activities as compared to existing conditions, because the project would not locate these activities closer to any noise-sensitive land uses than they already are under existing conditions. This effect is less than significant.

For those reasons stated above, implementation of the No-Action Alternative would result in mitigation measures **less-than-significant** effects related to operational traffic and recreation noise.

EFFECT NOI-3	Exposure of Sensitive Receptors to Operational Equipment Noise. *The project would not be implemented, and therefore would be no discharge pump stations that would potentially generate noise above county standards. No effect would occur.*

The project would not be implemented, and thus there would be no discharge pump stations that would potentially generate noise above county standards. Agricultural operations are exempt from county noise standards. **No effect** would occur.

EFFECT NOI-4	Exposure of Sensitive Receptors to Operational Noise from Ongoing Maintenance and Habitat Conservation Activities. *Because the project would not be implemented, there would be no maintenance and habitat conservation activities that would potentially generate noise above county standards. No effect would occur.*

Because the project would not be implemented, there would be no maintenance and habitat conservation activities that would potentially generate noise above county standards. **No effect** would occur.

Alternative 1 and Alternative 2 (Proposed Action)

The effects analysis and mitigation measures for Alternatives 1 and 2 are the same; therefore, they are described together under this heading.

EFFECT NOI-1	Exposure of Sensitive Receptors to Construction-Related Noise and Groundborne Vibration. *Project-related construction activities that occur during the daytime are exempt from local noise standards. Project-related construction activities that occur between the hours of 8 p.m. and 7 a.m., if any, would represent an adverse effect on noise-sensitive land uses. This effect is significant.*

Because groundborne vibration and noise attenuate more dramatically when compared to airborne noise, it is anticipated that groundborne vibration and noise from construction activities would not be perceptible to humans at the nearest noise-sensitive land uses due to the distance from construction activities. Therefore, the effect from groundborne vibration and noise is less than significant. (Effects on aquatic organisms from groundborne vibration related to pile driving in Sacramento-San Joaquin Delta (Delta) waterways are evaluated in Section 3.4, "Aquatic Resources.")

As shown in Tables 3.17-3 and 3.17-6 in Section 3.17, "Traffic and Transportation," project-related construction traffic under Alternatives 1 and 2 would result in a maximum of only 31-86 additional vehicle trips per day on the project islands and a maximum of only 9 additional peak-hour trips on any given segment of the local roadway network. This small increase in temporary and short-term roadway traffic would not result in a perceptible noise increase (i.e., 3 dBA or greater); therefore, construction traffic would result in a less-than-significant noise effect.

Construction of proposed facilities such as rock revetment on levees and installation of pump stations and siphon facilities, would result in a temporary increase in noise levels in the vicinity of these facilities, which could affect noise-sensitive land uses. However, construction noise occurring between the hours of 7a.m. and 8 p.m. is exempt from the San Joaquin and Contra Costa County noise standards, and therefore would result in a less-than-significant effect.

It is anticipated that noise levels from construction of proposed facilities would attenuate to imperceptible levels at the nearest noise-sensitive land use due to the distance of those land uses from construction activities. However, to be conservative, this analysis considers that if construction activities would take place between the more noise sensitive nighttime hours of 8 p.m. and 7 a.m., a **significant** effect would occur.

Mitigation Measure NOI-MM-1: Limit Construction Hours and Comply with all Applicable Local Noise Standards.

In addition to complying with all applicable local noise standards, the project applicant will limit construction activities that create noise near sensitive use areas to the hours between 7:00 a.m. and 8:00 p.m.

Implementation of Mitigation Measure NOI-MM-1 would reduce this effect to a **less-than-significant** level because the project would limit construction activities to the hours between 7 a.m. and 8 p.m.

EFFECT NOI-2 Exposure of Sensitive Receptors to Operational Traffic and Recreation Noise. *Project-related operational traffic would not result in a doubling (i.e., a 5 dBA increase) of noise along the local roadway network, and since no new recreational facilities would be constructed, there would be no project-related increase in recreation noise. This effect is less than significant.*

Traffic

Tables 3.17-3, 3.17-5, and 3.17-6 in Section 3.17, "Traffic and Transportation" show the projected total daily vehicle trip generation rates on the project islands and peak-hour volumes on the local roadway network during the operational phase of Alternatives 1 and 2. Tables 3.17-11 and 3.17-12 show the projected future traffic conditions with the Delta Wetlands project and other planned future projects.

Based on this data, it is anticipated that traffic volumes would increase by 3% on Bacon Island Road at the Bacon Island Road Bridge and 4% on Jersey Island Road north of Cypress Road. This would equate to a noise increase of substantially less than 1 dB on Bacon Island and Jersey Island Roads. As previously discussed in the "Affected Environment" subsection, in general, human sound perception is such that a change in sound level of 3 dBA is just noticeable, while a change of at least 5 dBA is required before any noticeable change in human response would be expected. Because the project-related increase in traffic noise levels along the project area roadway segments would not be perceptible, this effect is **less than significant**.

Recreation

Since no new recreation facilities would be constructed, there would be no project-related increase in recreational noise. **No effect** would occur.

Mitigation Measure: No mitigation is required.

EFFECT NOI-3	Exposure of Sensitive Receptors to Operational Equipment Noise. *Discharge pump stations on Bacon Island and Webb Tract would not be audible over the existing ambient noise at any noise-sensitive land uses in the project vicinity. This effect is less than significant.*

The only permanent noise-generating components of the project would be two discharge pump stations: one at the southeast corner of Bacon Island and one at the southern edge of Webb Tract (see Exhibits 2-1 and 2-2 in Chapter 2, "Project Description and Alternatives"). Pump noise would vary depending on several factors, including pump type (electric or diesel), drive motor horsepower, speed (revolutions per minute), and the distance to the nearest noise-sensitive receptor. According to reference source levels in Hoover & Keith (2008), pumps can generate noise levels of up to 80 dBA at a distance of 50 feet.

To provide a worst-case scenario for noise effects attributable to the proposed pump stations, this analysis assumed that a given pump potentially could operate continuously for a full hour during the nighttime period (10 p.m. to 7 a.m.). The nearest sensitive land uses (residential) to either of the two proposed pump stations are located on Bethel Island (in Contra Costa County), approximately 2.5 miles from the proposed pump station on Webb Tract, and based on the reference source level provided above, noise from the operation of the closest pump station is projected to attenuate to a noise level of 17 dBA and is not be anticipated to be audible over the existing ambient noise at any noise-sensitive land uses in the project vicinity. Therefore, this effect is **less than significant**.

Mitigation Measure: No mitigation is required.

EFFECT NOI-4	Exposure of Sensitive Receptors to Operational Noise from Ongoing Maintenance and Habitat Conservation Activities. *Ongoing maintenance and habitat conservation activities are expected to be infrequent and would occur at a distance of approximately 2.5 miles from the nearest sensitive receptor. This effect is less than significant.*

Ongoing maintenance of the proposed pump stations, diversion structures and fish screens, and levees would be conducted as necessary as part of the project. In addition, conservation activities would be performed intermittently on the Habitat Islands and may involve an exposure of sensitive uses to intermittent noise from vehicles and light maintenance equipment. However, these activities are anticipated to be relatively infrequent. Because of the intermittent nature of these activities and the relatively far distance of 2.5 miles to the nearest sensitive receptor, this effect is **less than significant**.

Mitigation Measure: No mitigation is required.

Alternative 3

EFFECT NOI-1	Exposure of Sensitive Receptors to Construction-Related Noise and Groundborne Vibration. *Project-related construction activities that occur during the daytime are exempt from local noise standards. Project-related construction activities that occur between the hours of 8 p.m. and 7 a.m., if any, would represent an adverse effect on noise-sensitive land uses. This effect is significant.*

It is anticipated that groundborne vibration from construction activities under Alternative 3 would not be perceptible at the nearest noise-sensitive land use due to the distance from construction activities. Therefore, the effect from groundborne vibration is less than significant. (Effects on aquatic organisms from ground-borne vibration related to pile driving in Delta waterways are evaluated in Section 3.4, "Aquatic Resources".)

As shown in Tables 3.17-3 and 3.17-6 in Section 3.17, "Traffic and Transportation," project-related construction traffic under Alternative 3 would result in a maximum of 72-159 additional vehicle trips per day on the project islands and a maximum of only 14 additional peak-hour trips on any given segment of the local roadway network. This increase in temporary and short-term roadway traffic would not result in a perceptible noise increase (i.e., 3 dBA or greater); therefore, construction traffic would result in a less-than-significant noise effect.

Although more construction-related noise would occur under Alternative 3 as compared to Alternatives 1 and 2 because additional facilities would be constructed to divert, store, and release more water, construction noise occurring between the hours of 7 a.m. and 8 p.m. is exempt from the San Joaquin and Contra Costa County noise standards, and therefore would result in a less-than-significant effect. It is anticipated that noise levels from construction of proposed facilities under Alternative 3 would attenuate to imperceptible levels at the nearest noise-sensitive land use due to the distance of those land uses from construction activities. However, to be conservative, this analysis considers that if construction activities would take place between the more noise sensitive nighttime hours of 8 p.m. and 7 a.m., a **significant** effect would occur.

> Mitigation Measure: Implement Mitigation Measure NOI-MM-1 (Limit Construction Hours and Comply with all Applicable Local Noise Standards).

Implementation of Mitigation Measure NOI-MM-1 would reduce this effect to a **less-than-significant** level because construction would be limited to the house of 7 a.m. and 8 p.m.

EFFECT NOI-2	Exposure of Sensitive Receptors to Operational Traffic and Recreation Noise. *Project-related operational traffic would not result in a doubling (i.e., a 5 dBA increase) of noise along the local roadway network, and since no new recreational facilities would be constructed, there would no increase in project-related recreation noise. This effect is less than significant.*

Traffic

Tables 3.17-3, 3.17-5, and 3.17-6 in Section 3.17, "Traffic and Transportation," show the projected total daily vehicle trip generation rates on the project islands and peak-hour volumes on the local roadway network during the operational phase of Alternative 3. Tables 3.17-11 and 3.17-12 show the projected future traffic conditions with the Delta Wetlands project and other planned future projects under Alternative 3.

Based on this data, it is anticipated that traffic volumes under Alternative 3 would increase by nearly the same amount projected under Alternatives 1 and 2; that is, approximately 3% on Bacon Island Road at the Bacon Island Road Bridge and approximately 4% on Jersey Island Road north of Cypress Road. This would equate to a noise increase of less than 1 dB on Bacon Island and Jersey Island Roads. As previously discussed in the "Affected Environment" subsection, in general, human sound perception is such that a change in sound level of 3 dBA is just noticeable, while a change of at least 5 dBA is required before any noticeable change in human response would be expected. Because the increase in traffic noise levels along the project area roadway segments would not be perceptible, this effect is **less than significant**.

Recreation

Since no new recreation facilities would be constructed, there would be no project-related increase in recreational noise. **No effect** would occur.

Mitigation Measure: No mitigation is required.

EFFECT NOI-3 **Exposure of Sensitive Receptors to Operational Equipment Noise.** *Discharge pump stations on the four project islands would not be audible over the existing ambient noise at any noise-sensitive land uses in the project vicinity. This effect is less than significant.*

Under Alternative 3, in addition to the discharge pump stations on Bacon Island and Webb Tract, one pump station would be operated on the southeast side of Bouldin Island and one pump station would be operated on the east side of Holland Tract (see Exhibits 2-5 and 2-6 in Chapter 2, "Project Description and Alternatives"). Pump noise would vary depending on several factors, including pump type (electric or diesel), drive motor horsepower, speed (revolutions per minute), and the distance to the nearest noise-sensitive receptor. According to reference source levels in Hoover & Keith (2008), pumps can generate noise levels of up to 80 dBA at a distance of 50 feet.

To provide a worst-case scenario for noise effects attributable to the proposed pump stations, this analysis assumed that a given pump potentially could operate continuously for a full hour during the nighttime period (10 p.m. to 7 a.m.). The nearest sensitive land uses (residential) to any of the proposed pump stations are located on neighboring islands approximately 2.5 miles from the proposed pump stations, and based on the reference source level provided above, noise from the operation of the closest pump station is projected to attenuate to a noise level of 17 dBA and is not be anticipated to be audible over the existing ambient noise at any noise-sensitive land uses in the project vicinity. Therefore, this effect is **less than significant**.

Mitigation Measure: No mitigation is required.

EFFECT NOI-4 **Exposure of Sensitive Receptors to Operational Noise from Ongoing Maintenance and Habitat Conservation Activities.** *Ongoing maintenance and habitat conservation activities are expected to be infrequent and would occur at a distance of approximately 2.5 miles from the nearest sensitive receptor. This effect is less-than-significant.*

Because all four islands would be used for water storage under Alternative 3, the CMP on Bouldin Island and Holland Tract would not be implemented and therefore any noise associated with ongoing conservation activities would not occur. Ongoing maintenance of the proposed pump stations, diversion structures and fish screens, and levees on all four project islands would be conducted as necessary as part of the project. However, these activities are anticipated to be relatively infrequent. Because of the intermittent nature of these activities and the relatively far distance of 2.5 miles from the nearest sensitive receptor, this effect is **less than significant**.

Mitigation Measure: No mitigation is required.

Table 3.13-4
Delta Wetlands Project SEIS Effects and Mitigation Measures for Noise

Alternatives 1 and 2 (Proposed Action)
Effect NOI-1: Exposure of Sensitive Receptors to Construction-Related Noise and Groundborne Vibration (LTS-M) **Mitigation Measure NOI-MM-1:** Limit Construction Hours and Comply with all Applicable Local Noise Standards
Effect NOI-2: Exposure of Sensitive Receptors to Operational Traffic and Recreation (LTS) **Mitigation:** No mitigation is required.
Effect NOI-3: Exposure of Sensitive Receptors to Operational Equipment Noise (LTS) **Mitigation:** No mitigation is required.
Effect NOI-4: Exposure of Sensitive Receptors to Operational Noise from Ongoing Maintenance and Habitat Conservation Activities (LTS)

Table 3.13-4 Delta Wetlands Project SEIS Effects and Mitigation Measures for Noise
Mitigation: No mitigation is required.
Alternative 3
Effect NOI-1: Exposure of Sensitive Receptors to Construction-Related Noise and Groundborne Vibration (LTS-M) **Mitigation Measure NOI-MM-1:** Limit Construction Hours and Comply with all Applicable Local Noise Standards
Effect NOI-2: Exposure of Sensitive Receptors to Operational Traffic and Recreation (LTS) **Mitigation:** No mitigation is required.
Effect NOI-3: Exposure of Sensitive Receptors to Operational Equipment Noise (LTS) **Mitigation:** No mitigation is required.
Effect NOI-4: Exposure of Sensitive Receptors to Operational Noise from Ongoing Maintenance and Habitat Conservation Activities (LTS) **Mitigation:** No mitigation is required.
Notes: LTS = Less than significant; LTS-M = Less than significant with mitigation Source: AECOM 2014

3.13.6 SECONDARY AND CUMULATIVE EFFECTS

Secondary and cumulative noise effects resulting from implementing the project are presented below and are summarized in Table 3.13-5.

Exposure of Sensitive Receptors to Construction Noise

Construction noise generated by the project would be temporary, short-term, and highly localized. All construction activities in San Joaquin and Contra Costa Counties are subject to the same noise exemption when construction occurs between the hours of 7 a.m. and 8 p.m. Implementing Mitigation Measure NOI-MM-1 would ensure that project-related noise activities occur between 7 a.m. and 8 p.m. The four project islands and areas that are in close proximity thereto are very rural in nature and in general are lacking in sensitive receptors. Considering that noise greatly attenuates with distance and there are no other known cumulative projects immediately adjacent to the locations where Delta Wetlands construction activity would occur, the project would not result in cumulatively considerable contribution to construction noise effects.

Exposure of Sensitive Receptors to Operational Traffic Noise

Effect NOI-2 for operational traffic noise effects described above at the project-level also includes cumulative operational traffic noise effects, because the traffic modeling considers both the project and the related cumulative projects under 2012 and 2030 conditions (see Tables 3.17-11 and 3.17-12 in Section 3.17, “Traffic and Transportation”). As described in Effect NOI-2, traffic would increase by approximately 3% on Bacon Island Road at the Bacon Island Road Bridge and approximately 4% on Jersey Island Road north of Cypress Road. This would equate to a noise increase of less than 1 dB on Bacon Island and Jersey Island Roads. As previously discussed in the “Affected Environment” subsection, in general, human sound perception is such that a change in sound level of 3 dBA is just noticeable, while a change of at least 5 dBA is required before any noticeable change in human response would be expected. Because the increase in traffic noise levels along the project area roadway segments would not be perceptible, the project would not result in cumulatively considerable contribution to roadway traffic noise.

Exposure of Sensitive Receptors to Operational Recreation Noise

As discussed in Section 3.17, “Traffic and Transportation,” boat-related recreational activity in the Delta has increased in recent years. Approximately 32,384 boats were registered in Contra Costa County in 2011, and 23,597 boats were registered in San Joaquin County in 2011. As boat-related traffic increases, so does the attendant boating noise from engines, human voices, and radios. While implementation of the related projects may result in a cumulatively significant effect from increased recreational noise, new recreational facilities would not be constructed as part of the Delta Wetlands project. Therefore, the project would not contribute to this cumulative effect.

Exposure of Sensitive Receptors to Operational Maintenance and Habitat Conservation Noise

Activities associated with maintenance activities, and habitat conservation activities under Alternative 3, are anticipated to be relatively infrequent. Because of the intermittent nature of these activities and the relatively far distance of 2.5 miles to the nearest sensitive receptor, and considering that noise greatly attenuates with distance and there are no other known cumulative projects immediately adjacent to the locations where Delta Wetlands activity would occur, the project would not result in cumulatively considerable contribution to maintenance and/or conservation noise effects.

Table 3.13-5 **Secondary and Cumulative Noise Effects this SEIS**
Exposure of Sensitive Receptors to Construction Noise (NCC) **Mitigation:** No mitigation is required.
Exposure of Sensitive Receptors to Operational Traffic Noise (NCC) **Mitigation:** No mitigation is required.
Exposure of Sensitive Receptors to Operational Recreation Noise (NCC) **Mitigation:** No mitigation is required.
Exposure of Sensitive Receptors to Operational Maintenance and Habitat Conservation Noise (NCC) **Mitigation:** No mitigation is required.
Notes: NCC = Not cumulatively considerable; NCC-M = Not cumulatively considerable with mitigation Source: AECOM 2014

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3.14 PARKS AND RECREATION

3.14.1 INTRODUCTION

This section describes recent changes to the existing environmental conditions and regulatory framework of the project study area, summarizes the unchanged affected environment, and describes changed environmental effects related to parks and recreation for the project. A review and update of the 1995 DEIR/EIS recreation assessment was incorporated in the 2001 FEIS. Chapter 3J in the 2001 FEIS provided detailed information regarding recreation resources associated with the project and in the Sacramento-San Joaquin Delta (Delta) in general. The recreation effects of the project were analyzed most recently in Section 4.9 and Chapter 5 of the 2010 DEIR, which also served as a basis for this analysis. The 1995 DEIR/EIS, 2001 FEIS, and 2010 DEIR are herein incorporated by reference.

The 2001 FEIS concluded that the project would affect recreation in the vicinity of the four project islands. Since that time, there have been no changes in the project that result in new significant adverse environmental effects or a substantial increase in the severity or intensity of previously identified significant adverse effects on recreational resources.

There have been minor changes in the "Regulatory Framework/Applicable Laws, Regulations, Plans, and Policies" subsection since the 2001 FEIS, but these changes do not alter the conclusions in the 2001 FEIS regarding environmental effects on recreational resources. The 2001 FEIS recreation analysis has been updated here to update the "Affected Environment" subsection for recreational resources. These additions and updates as listed below are minor and do not change the effects analysis or mitigation for this SEIS.

The project would not have any direct adverse effects on recreational resources in the places of use; the effects on recreation, if any, associated with the provision of project water to the places of use are addressed in the "Secondary and Cumulative Effects" subsection below, and in Chapter 4, "Other Statutory Requirements."

Identification of the project's specific places of use does not affect recreation in any way that alters the conclusions of the 2001 FEIS. There are no major unanalyzed effects on these resources at the places of use. Any minor changes in the "Affected Environment" and "Regulatory Framework/Applicable Laws, Regulations, Plans, and Policies" subsections since the 2001 FEIS do not alter the prior document's conclusions, and such changes are addressed by the urban water management plan EIR of each affected place of use.

SUMMARY OF CHANGES, NEW CIRCUMSTANCES, AND NEW INFORMATION

Substantial Changes in the Project

Since the 2001 FEIS was completed, there have been no substantial changes in the project resulting in new significant adverse effects or substantial increase in the severity or intensity of effects on parks and recreation. However, the project no longer includes a proposal to construct new recreation facilities on the Reservoir or Habitat Islands; this change to the project results in a reduction and/or elimination of some the previously identified environmental effects.

New Circumstances

Since the 2001 FEIS, there have been no new circumstances that result in new significant adverse effects or substantial increase in the severity or intensity of effects on parks and recreation.

New Information

There is no new information that would result in new significant adverse effects or a substantial increase in the severity or intensity of effects on parks and recreation.

SUMMARY OF ENVIRONMENTAL COMMITMENTS

Environmental commitments are measures incorporated by the project applicant as part of the project, meaning they are proposed as elements of the Proposed Action and are therefore considered in conducting the environmental analysis for each resource area of this SEIS. The purpose of environmental commitments is to reflect and incorporate best practices into the project that avoid, minimize, reduce, or offset potential adverse environmental effects. A complete description of the environmental commitments that have been incorporated into the project since the 2001 FEIS is contained in Chapter 2, "Project Description and Alternatives" of this SEIS. There are no environmental commitments that would affect the analysis or effect conclusions related to parks and recreation.

3.14.2 AFFECTED ENVIRONMENT

The primary unit of measurement of recreation use is the recreation use-day, which represents participation by one individual in a recreational activity during any portion of a 24-hour period. Participation in hunting, fishing, or boating by one individual during a 24-hour period represents 1 recreation use-day. Participation in all three activities during a 24-hour period represents 3 recreation use-days.

RECREATIONAL USES IN THE REGION

The Delta is generally bounded by the cities of Sacramento, Stockton, Tracy, and Pittsburg. Delta recreation is supported by these major population centers and the San Francisco Bay Area in general. Recreation use in the Delta exceeds 12 million user-days annually. Boating is the most popular recreation activity in the Delta, followed by fishing (not including boating), and finally, hunting. The Delta Protection Commission reported that hunting has declined in California with the number of resident hunting licenses issued down 61% between 1970 and 1998, and the number of state duck stamps down 58% in the same period (ICF 2001:3J-3). Fishing has remained popular in the Delta and throughout California, with a slight decrease (8%) in the same period. However, the overall demand for recreation opportunities in the Delta is expected to increase as a result of increased population, higher incomes, and increased numbers of retirees.

Approximately 120 commercial recreation facilities exist in the Delta, including at least 100 marinas (see 2001 FEIS Figure 3J-1). Delta marinas provide services to regional boaters that include temporary and permanent boat berthing, mooring, and dry storage. Most marinas operate at 50–90% capacity. Other commercial facilities include resorts, restaurants with guest docks, and recreational vehicle parks. The Delta also contains public recreation facilities that include areas or facilities for boat launching, camping, fishing access, swimming, and picnicking.

On many privately owned Delta islands, owners and their guests hunt waterfowl on agricultural lands. Most of the private hunting clubs in the Delta are small, accommodating between 8 and 16 hunters on a typical shoot day. Landowners manage private hunting clubs on Delta islands which, in some cases, occur on lands that are no longer in agricultural production.

Recreational Uses on the Project Islands

Bacon Island

No waterfowl hunting takes place on Bacon Island. Pheasant hunting is permitted by invitation only and is limited primarily to on-site workers and their families. The total number of hunting recreation use-days per season is estimated to be 100.

Approximately 90% of the fishing on Bacon Island takes place adjacent to Bacon Island Road, which is the only means of public access. Although there are no designated public access areas along the roadway for fishing, members of the public fish the Middle River from the island perimeter levee adjacent to Bacon Island Road. No other areas of Bacon Island are accessible to the public. Therefore, fishing from other parts of the island (i.e., away from the county roadway) is limited to relatives and employees of property owners; trespassers who fish in those areas are asked to leave. Total fishing activity is estimated to be 3,120 recreation use-days per year on Bacon Island.

Although there are no marinas or boat docks on Bacon Island, about 35% of the anglers use boats to gain access to Delta waterways adjacent to Bacon Island. The remaining anglers (approximately 65%) fish from the levee adjacent to the county road.

Webb Tract

No public hunting takes place on Webb Tract; hunting is limited to family and friends of the owners. A total of 640 recreation use-days per season occur on Webb Tract for hunting activities. Waterfowl hunting use is estimated at 320 recreation use-days per season. There is some private pheasant hunting, limited to friends and family of property owners, which also amounts to about 320 recreation use-days per season.

Written permission from the property owners is required for fishing on Webb Tract. Anglers occasionally fish the northern blowout pond on Webb Tract. Fishing activity on Webb Tract totals approximately 90 recreation use-days per year. No boating activity originates from Webb Tract.

Bouldin Island

Waterfowl hunting on Bouldin Island is limited to invited guests, totaling approximately 150 hunting recreation use-days per year. Hunting facilities on the island consist of a building used to store waterfowl hunting equipment. Pheasant hunting on Bouldin Island also is limited to invited guests and totals about 60 hunting recreation use-days per year.

On-site workers who fish from levees account for most of the fishing on Bouldin Island. Written permission is needed for others visiting the island. Fishing activity averages two anglers per day, for a total of about 360 fishing recreation use-days per season. No boating originates from Bouldin Island.

Holland Tract

One landowner on Holland Tract accommodates for-fee hunting, which constitutes approximately 80% of the waterfowl hunting on this property. The remainder consists of hunting by friends and family of the landowner. Approximately two people hunt per day, for a total of about 50 hunting recreation use-days per season for waterfowl. Other property owners on Holland Tract either do not allow hunting or limit hunting to members of their immediate families. Total waterfowl hunting per season on these properties totals about 10–15 recreation use-days. Pheasant hunting takes place primarily on the west side of Holland Tract. Hunters are charged a fee to visit the island. Approximately 20% of all hunting is non-fee hunting that is limited to friends and family of the landowner. The island generates approximately 30 hunting recreation use-days per season for pheasant. An estimated 80% of the hunters make day trips, and approximately 20% stay overnight in the local area.

Approximately half the overnight users stay in hotels, and the other half stay in campgrounds. Hunting facilities on Holland Tract consist of a building used as a clubhouse.

Most fishing on Holland Tract originates from two marinas on the south end of the island. Marina tenants generate an estimated 4,000 fishing recreation use-days per year. Fishing activities associated with the launch ramp (day-use boaters) account for another 4,500-7,700 fishing recreation use-days annually. Fishing from the levees accounts for approximately 200 fishing recreation use-days per year. Total fishing on Holland Tract thus ranges from 8,700 to 11,900 recreation use-days annually.

Two marinas located on Holland Tract presently support recreational boating near the island. The larger marina, located on the southeastern corner of the island, accommodates 235 boats more than 26 feet long and 100 boats less than 20 feet long. Boat slip occupancy at this marina averages approximately 85%, with the summer months being especially busy. Boat slips account for an estimated 24,100 boating recreation use-days per season.

The larger marina also has other facilities, including a fuel dock, a snack shack, a launch ramp, and a 500-foot guest dock. The launch ramp is used by day-use boaters. The launch ramp generates an estimated additional 22,750-38,500 boating recreation use-days per season at Holland Tract. Most launch ramp use is related to waterskiing. Approximately 20% of the launch ramp boating activity is related to fishing.

The other marina on Holland Tract, located on the south shore, has a 21-berth capacity. Total boating generated by this facility is estimated to be 1,500 recreation use-days per season.

3.14.3 Regulatory Framework/Applicable Laws, Regulations, Plans, and Policies

Federal applicable laws and regulations are provided because they are required under NEPA. State applicable laws and regulations are provided for informational purposes and to assist with NEPA review. USACE has considered applicable state, regional, and local plans and ordinances as a part of the environmental review process for this SEIS, where applicable.

Federal

There are no Federal laws, regulations, plans, or policies related to parks and recreation that would apply to the Proposed Action or the alternatives under consideration.

State

Land Use and Resource Management Plan for the Primary Zone of the Delta

The Environmental section of the Land Use and Resource Management Plan for the Primary Zone of the Delta (LURMP) acknowledges how permanent flooding can have an adverse effect on recreational activities while recreational activities can have an adverse effect on habitat, and includes findings, policies, and recommendations to balance these effects. The Land Use section of the LURMP includes findings, policies, and recommendations to support the promotion of recreation in appropriate locations. The Water section of the LURMP includes findings, policies, and recommendations to protect the long-term water quality in the Delta, in addition to other reasons, for recreation. The Recreation and Access section of the LURMP identifies the Delta as a region that is unique and well noted for its water-oriented recreation. This section includes findings, policies, and recommendations to promote and protect recreational uses in the Delta (Delta Protection Commission 2010).

3.14.4 ASSESSMENT METHODOLOGY

This analysis of environmental effects on recreational resources was prepared by considering the significance criteria listed below in relationship to anticipated project-related activities. Recreation effects were evaluated by comparing changes in hunting, fishing, and boating use that would occur under the Proposed Action and alternatives considered herein with estimates of current recreational uses.

SIGNIFICANCE CRITERIA

The basis for determining the significance of effects for this analysis is based on professional standards, project-specific criteria developed by the lead agency to address potential effects unique to the project's location and elements, and is informed by the criteria contained in the Environmental Checklist in Appendix G of the State CEQA Guidelines. These thresholds encompass the factors taken into account under NEPA to determine the significance of an action in terms of its context and the intensity of its effects. The Proposed Action or alternatives under consideration would have a significant, adverse effect on parks and recreation if they would do any of the following:

- result in a substantial decrease in recreation use-days in the Delta, or
- result in a substantial reduction in the quality of existing recreation experiences in the Delta.

The Proposed Action or alternatives under consideration would have a beneficial effect on recreation if it would provide additional recreation opportunities in the project area.

3.14.5 ENVIRONMENTAL CONSEQUENCES AND MITIGATION MEASURES

EFFECTS ANALYSIS

Recreation effects resulting from project implementation were described in the 2001 FEIS and are listed in Table 3.14-1. Where there have been no changes to the effects analysis or conclusions, the 2001 FEIS is herein incorporated by reference, and the effect conclusions and mitigation measures are briefly summarized.

No-Action Alternative

EFFECT REC-1 **Increase in Hunting Opportunities on the Project Islands.** *Annual hunting recreation use-days would increase under the No-Action Alternative. This effect is beneficial and less than significant.*

Under the No-Action Alternative, an intensive for-fee hunting program would be operated on the project islands. This program would generate approximately 12,000 additional recreation use-days, resulting in a 17% increase over the existing hunting recreation use-days in the Delta. This effect is **beneficial and less than significant.**

EFFECT REC-2 **Change in Regional Hunter Success Outside the Project Area.** *There would be no redistribution of waterfowl populations to the Habitat Islands, and thus there would be no effect on the availability of waterfowl hunting outside of the project islands. No effect would occur.*

Because the proposed Compensatory Mitigation Plan (CMP) would not be implemented under the No-Action Alternative, creation of wintering waterfowl compensation habitat on the Habitat Islands would not occur, and therefore redistribution of regional waterfowl populations to the Habitat Islands that may cause a decrease in hunter success outside the project area would not take place. Thus, there would be **no effect.**

EFFECT REC-3 **Increase in Recreation Use-Days for Boating in the Delta.** *The No-Action Alternative would not result in a substantial increase in recreational boating activities in Delta waterways. This effect is less than significant.*

Keeping the project islands in agricultural production under the No-Action Alternative would not substantially change the number of boating-related recreation use-days, nor would it change the quality of the recreational boating experience in Delta Channels. The number of recreation use-days for boating would increase slightly because of boat-related transportation associated with the proposed for-fee hunting program. However, no additional boating facilities would be provided and no change to existing boating facilities would occur. There would also be no change to the uses on the project islands or how they would function. This effect is **less than significant.**

EFFECT REC-4 **Change in the Quality of the Recreational Boating Experience in Delta Channels.** *The continuation of agricultural activities and proposed for-fee hunting program under the No-Action Alternative would have no effect on the quality of recreational boating experiences in Delta channels. No effect would occur.*

Under the No-Action Alternative, the proposed water storage facilities and habitat compensation on the project islands would not be implemented. The continuation of agricultural activities and the proposed for-fee hunting program under the No-Action Alternative would have no effect on the quality of recreational boating experiences in Delta channels. **No effect** would occur.

EFFECT REC-5 **Increase in Recreation Use-Days for Other Recreational Uses in the Delta.** *The continuation of agricultural activities under the No-Action Alternative would have no effect on recreation use-days for other recreational uses in the Delta. No effect would occur.*

Keeping the project islands in agricultural production under the No-Action Alternative would not change the types of recreational uses in the Delta that currently exist, nor would it change the quality of the existing recreational experiences. The number of recreation use-days for activities other than those previously discussed above, such as relaxing, sightseeing, camping, picnicking, photography, birding, and bicycling, would not change because there would be no change to the uses on the project islands or how they would function. **No effect** would occur.

Alternative 1 and Alternative 2 (Proposed Action)

The effects analysis and mitigation measures for Alternatives 1 and 2 are the same; therefore, they are described together under this heading.

EFFECT REC-1 **Increase in Hunting Opportunities on the Project Islands.** *Waterfowl habitat on Reservoir and Habitat Islands would increase, and therefore annual hunting recreation use-days for existing private recreation facilities would also increase. This effect is beneficial and less than significant.*

Implementation of Alternatives 1 and 2 would result in a net increase of low- to medium-quality shallow-water wetland waterfowl habitat on Reservoir Islands during some years (see Tables 3.14-1 and 3.14-2). All the Reservoir Island acreage would be in a water storage condition in some years. High-quality wintering waterfowl compensation habitat would be created on the Habitat Islands that would also support upland game. Although the combined habitats for waterfowl and upland game could increase annual existing private hunting recreation use-days in the Delta, the project does not include the construction of new recreation facilities. This effect is **beneficial and less than significant**.

Mitigation Measure: No mitigation is required.

EFFECT REC-2 **Change in Regional Hunter Success Outside the Project Area.** *Redistribution of waterfowl populations to the Habitat Islands could affect the availability of waterfowl hunting outside of the project islands. This effect is less than significant.*

Implementation of Alternatives 1 and 2 would result in the creation of wintering waterfowl compensation habitat on the Habitat Islands, resulting in some redistribution of regional waterfowl populations to the Habitat Islands that may cause a decrease in hunter success outside the project area, especially in areas where wintering waterfowl habitat management and waterfowl hunting are secondary to other uses.

However, the decrease in hunter success outside the project area likely would be offset by an increase in waterfowl populations that the project attracts to the region. Also, during hunt days when waterfowl retreat from Habitat Islands, they move to other areas in the Delta where they could be hunted. Waterfowl also forage in other areas as food sources diminish on Habitat Islands during the winter. Additionally, implementation of the proposed CMP (discussed in Chapter 2, “Project Description and Alternatives”) would include establishment of waterfowl breeding habitat that would be expected to increase numbers of waterfowl in the region. Overall, project implementation would not result in a substantial reduction in the quality of existing recreation experiences in the Delta. This effect is **less than significant**.

Mitigation Measure: No mitigation is required.

EFFECT REC-3 **Increase in Recreation Use-Days for Boating in the Delta.** *New project-related recreational facilities would not be constructed; therefore, the project would not provide an increase in boat-related recreation opportunities in the Delta. No effect would occur.*

Implementation of Alternatives 1 and 2 would not result in an increase of annual boater use-days at project build out because no new project-related recreational facilities would be constructed. Therefore, the project would have **no effect** on boating-related recreation use-days.

Mitigation Measure: No mitigation is required.

EFFECT REC-4 **Change in the Quality of the Recreational Boating Experience in Delta Channels.** *No new project-related recreation facilities would be constructed; therefore, the project would not change the quality of the recreational boating experience in Delta channels. No effect would occur.*

Implementing Alternative 1 or 2 would not increase boat congestion in Delta channels and would not alter existing boating conditions on waterways adjacent to the project islands because no new project-related recreational facilities would be constructed. Therefore, **no effect** would occur.

Mitigation Measure: No mitigation is required.

EFFECT REC-5 **Increase in Recreation Use-Days for Other Recreational Uses in the Delta.** *No new project-related recreational facilities would be constructed; therefore, the project would not result in an increase in recreation use-days for other recreational activities in the Delta. No effect would occur.*

Implementing Alternatives 1 and 2 would not increase opportunities for Delta recreational activities such as relaxing, sightseeing, camping, picnicking, photography, birding, and bicycling because no new project-related recreational facilities would be constructed. Thus, there would no change in recreation use-days and **no effect** would occur.

Mitigation Measure: No mitigation is required.

Alternative 3

EFFECT REC-1 **Increase in Hunting on the Project Islands.** *Waterfowl habitat on the Reservoir and Habitat Islands would increase, and therefore annual hunting recreation use-days would also increase. This effect is beneficial and less than significant.*

Implementing Alternative 3 would result in water storage on all four project islands; therefore, a net increase of shallow-water wetland habitat on the four islands would occur in some operating years, which would provide low- to medium-quality waterfowl foraging habitat. The proposed CMP would not be implemented, and therefore the large amount of high-quality wintering waterfowl compensation habitat that would occur under Alternatives 1 and 2 would not be created. Under Alternative 3, most of the North Bouldin Habitat Area (NBHA), encompassing approximately 875 acres, would be available for waterfowl and existing private upland game hunting during the hunting seasons. Water storage on the project islands would allow waterfowl to rest on the open water and possibly forage in shallow areas around the storage pool edges. The project islands would also support a net increase in annual recreation use-days in the Delta for waterfowl and existing private upland game hunting. Therefore, this effect is **beneficial and less than significant**.

Mitigation Measure: No mitigation is required.

EFFECT REC-2 **Change in Regional Hunter Success Outside the Project Area.** *The proposed CMP would not be created, waterfowl would likely not redistribute to the project islands, and therefore hunter success outside the project area likely would increase. This effect is less than significant*

Under Alternative 3, the proposed CMP to establish waterfowl breeding habitat on the Habitat Islands would not be implemented. As a result, waterfowl would likely not widely redistribute to Bouldin Island and Holland Tract, as would be expected to occur under Alternatives 1 and 2. Therefore, hunter success outside the project area likely would increase. This effect is **less than significant**.

Mitigation Measure: No mitigation is required.

EFFECT REC-3 **Increase in Recreation Use-Days for Boating in the Delta.** *New project-related recreational facilities would not be constructed; therefore, the project would not provide an increase in boat-related recreation opportunities in the Delta. No effect would occur.*

Implementing Alternative 3 would not result in an increase of annual boater use-days at project build out because no new project-related recreational facilities would be constructed. Therefore, the project would have **no effect** on boating-related recreation use-days.

Mitigation Measure: No mitigation is required.

EFFECT REC-4 **Change in the Quality of the Recreational Boating Experience in Delta Channels.** *No new project-related recreational facilities would be constructed; therefore, the project would not change the quality of the recreational boating experience in Delta channels. No effect would occur.*

As with Alternatives 1 and 2, implementing Alternative 3 would also not increase boat congestion in Delta channels and would not alter existing boating conditions on waterways adjacent to the project islands because no new project-related recreational facilities would be constructed. Therefore, **no effect** would occur.

Mitigation Measure: No mitigation is required.

EFFECT REC-5	Increase in Recreation Use-Days for Other Recreational Uses in the Delta. *No new project-related recreational facilities would be constructed; therefore, the project would not result in an increase in recreation use-days for other recreational activities in the Delta. No effect would occur.*

Implementing Alternative 3 would not increase participation in other recreational activities in the Delta such as relaxing, sightseeing, camping, picnicking, photography, birding, and bicycling because no new project-related recreational facilities would be constructed. Thus, there would no change in recreation use-days and **no effect** would occur.

Mitigation Measure: No mitigation is required.

Table 3.14-1
Comparison of Delta Wetlands Project 2001 FEIS and this SEIS Effects and Mitigation Measures for Parks and Recreation

2001 FEIS Effects and Mitigation Measures	SEIS Effects and Mitigation Measures
Alternatives 1 and 2 (Proposed Action)	
Impact J-1: Increase in Recreation Use-Days for Hunting in the Delta (B) **Mitigation:** No mitigation is required.	**Effect REC-1:** Increase in Hunting on the Project Islands (B and LTS) **Mitigation:** No mitigation is required. New data has been incorporated into the analysis, but conclusions have not changed.
Impact J-2: Change in Regional Hunter Success outside the Project Area (LTS) **Mitigation:** No mitigation is required.	**Effect REC-2:** Change in Regional Hunter Success outside the Project Area (LTS) **Mitigation:** No mitigation is required. No change.
Impact J-3: Increase in Recreation Use-Days for Boating in the Delta (B and LTS) **Mitigation:** No mitigation is required.	**Effect REC-3:** Increase in Recreation Use-Days for Boating in the Delta (NI) **Mitigation:** No mitigation is required. The effect analysis and conclusion have been changed to reflect the fact that no new project-related recreational facilities would be constructed.
Impact J-4: Change in the Quality of the Recreational Boating Experience in Delta Channels (LTS-M) **Mitigation Measure RJ-1:** Reduce the Number of Outward Boat Slips Located at Recreation Facilities.	**Effect REC-4:** Change in the Quality of the Recreational Boating Experience in Delta Channels (NI) **Mitigation:** No mitigation is required. The effect analysis and conclusion have been changed to reflect the fact that no new project-related recreational facilities would be constructed.
Impact J-5: Increase in Recreation Use-Days for Other Recreational Uses in the Delta (B and LTS) **Mitigation:** No mitigation is required.	**Effect REC-5:** Increase in Recreation Use-Days for Other Recreational Uses in the Delta (NI) **Mitigation:** No mitigation is required. The effect analysis and conclusion have been changed to reflect the fact that no new project-related recreational facilities would be constructed.

Table 3.14-1 Comparison of Delta Wetlands Project 2001 FEIS and this SEIS Effects and Mitigation Measures for Parks and Recreation	
2001 FEIS Effects and Mitigation Measures	SEIS Effects and Mitigation Measures
Alternative 3	
Impact J-12: Increase in Recreation Use-Days for Hunting in the Delta (B) **Mitigation:** No mitigation is required.	**Effect REC-1:** Increase in Hunting on the Project Islands (B and LTS) **Mitigation:** No mitigation is required. New data has been incorporated into the analysis, but the conclusions have not changed.
Not previously evaluated.	**Effect REC-2:** Change in Regional Hunter Success outside the Project Area (LTS) **Mitigation:** No mitigation is required.
Impact J-13: Increase in Recreation Use-Days for Boating in the Delta (B) **Mitigation:** No mitigation is required.	**Effect REC-3:** Increase in Recreation Use-Days for Boating in the Delta (NI) **Mitigation:** No mitigation is required. The effect analysis and conclusion have been changed to reflect the fact that no new project-related recreational facilities would be constructed.
Impact J-14: Change in the Quality of the Recreational Boating Experience in Delta Channels (LTS-M) **Mitigation Measure RJ-1:** Reduce the Number of Outward Boat Slips Located at Recreation Facilities	**Effect REC-4:** Change in the Quality of the Recreational Boating Experience in Delta Channels (NI) **Mitigation:** No mitigation is required. The effect analysis and conclusion have been changed to reflect the fact that no new project-related recreational facilities would be constructed.
Impact J-15: Increase in Recreation Use-Days for Other Recreational Uses in the Delta (B) **Mitigation:** No mitigation is required.	**Effect REC-5:** Increase in Recreation Use-Days for Other Recreational Uses in the Delta (NI) **Mitigation:** No mitigation is required. The effect analysis and conclusion have been changed to reflect the fact that no new project-related recreational facilities would be constructed.
Notes: Shading denotes changes in the effect, significance conclusion, or mitigation measure from the 2001 FEIS; NI = No impact; LTS = Less than significant; B = Beneficial Sources: ICF 2010:4.9-2 through 4.9-5 and AECOM 2014	

3.14.6 Secondary and Cumulative Effects

Secondary and cumulative recreation effects resulting from project implementation were described in the 2001 FEIS (Chapter 3J) and 2010 DEIR (Chapter 5). The 2001 FEIS and 2010 DEIR are incorporated by reference herein, and the effect conclusions and mitigation measures, along with any changes, are summarized briefly below and shown in Table 3.14-2.

Increase in Recreation Opportunities in the Delta

Project implementation, concurrent with other agricultural conversion projects and the California Department of Water Resources water management programs, may result in an increase in recreation opportunities throughout the Delta. Although the North Delta Flood Control and Ecosystem Restoration Project (North Delta Project) is not currently funded for implementation, the 2008 EIR prepared for the North Delta Project included objectives to enhance Delta recreation, and called for channel and levee improvements that may improve access for boaters and anglers. The South Bay Salt Ponds Project also aims to enhance recreation access and opportunities near the Delta region. In addition, the North Delta project, the CALFED Ecosystem Restoration Program, and the Franks Tract Project all have ecosystem restoration components that could improve fishery conditions and support increased fishing in the Delta.

Implementation of agricultural conversion projects by state and Federal agencies would be expected to include provisions for public access and new opportunities for recreation in the Delta. Project implementation would provide an increased amount of waterfowl habitat of varying quality for use by existing private hunting clubs. Therefore, this cumulative effect is beneficial.

Enhancement of Waterfowl Populations and Increased Hunter Success in the Delta

Project implementation, concurrent with other proposed agricultural conversion projects throughout the Delta, would be expected to reduce available waste grain for waterfowl foraging habitat. However, projects that result in the conversion of agricultural land used by waterfowl for foraging would be required to compensate for the loss of wintering waterfowl foraging habitat. The overall effect of proposed projects in the Delta, including the Delta Wetlands project, would be beneficial for waterfowl foraging habitat. This analysis assumes that adverse effects of agricultural conversion projects would be mitigated or otherwise offset through implementation of other beneficial projects. Because projects in the Delta are expected to enhance or maintain habitat values overall, waterfowl would be expected to continue to use the Delta. Hunter success, therefore, may increase throughout the Delta. This cumulative effect is beneficial.

Table 3.14-2
Comparison of Secondary and Cumulative Parks and Recreation Effects between the 2001 FEIS and this SEIS

2001 FEIS Cumulative Effects and Mitigation Measures	SEIS Cumulative Effects and Mitigation Measures
Impact J-23: Increase in Recreation Opportunities in the Delta (B) **Mitigation:** No mitigation is required.	Increase in Recreation Opportunities in the Delta (B) **Mitigation:** No mitigation is required. No change.
Impact J-24: Enhancement of Waterfowl Populations and Increased Hunter Success in the Delta (B) **Mitigation:** No mitigation is required.	Enhancement of Waterfowl Populations and Increased Hunter Success in the Delta (B) **Mitigation:** No mitigation is required. No change.

Notes: Shading denotes changes in the effect, significance conclusion, or mitigation measure from the 2001 FEIS; NCC-M = Not cumulatively considerable with Mitigation; B = Beneficial

Sources: ICF 2010:5-33 and AECOM 2014

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3.15 PUBLIC SERVICES

3.15.1 INTRODUCTION

This section describes recent changes to the existing environmental conditions and regulatory framework/ applicable laws, regulations, plans, and policies of the project study area, summarizes the unchanged affected environment, and describes changed environmental effects related to public services for the project. A review and update of the 1995 DEIR/EIS public services assessment was incorporated in the 2001 FEIS. Chapter 3E in the 2001 FEIS provided detailed information regarding public services associated with the project and in the Sacramento-San Joaquin Delta (Delta) in general. The public services effects of the project were analyzed most recently in Section 4.4 and Chapter 5 of the 2010 DEIR, which also served as a basis for this analysis. The 1995 DEIR/EIS, 2001 FEIS, and 2010 DEIR are herein incorporated by reference.

The 2001 FEIS concluded that the project alternatives would affect public services. Since that time, there have been minor changes in the "Affected Environment." However, there have been no changes in the project that result in new significant adverse environmental effects or a substantial increase in the severity or intensity of previously identified significant effects on public services.

Identification of the project's specific places of use does not affect public services in any way that alters the conclusions of the 2001 FEIS. The project would not have any direct adverse effects on public services in the places of use; the effects on public services, if any, associated with the provision of project water to the place of use are addressed in the "Secondary and Cumulative Effects" subsection below and in Chapter 4, "Other Statutory Requirements."

SUMMARY OF CHANGES, NEW CIRCUMSTANCES, AND NEW INFORMATION

Substantial Changes in the Project

Since the 2001 FEIS was completed, there have been no substantial changes in the project resulting in new significant adverse effects or substantial increase in the severity or intensity of effects on public services. However, the project no longer includes a proposal to construct new recreation facilities on the Reservoir or Habitat Islands; this change to the project results in a reduction and/or elimination of some the previously identified environmental effects.

New Circumstances

Since the 2001 FEIS was completed, there have been no substantial new circumstances resulting in new significant adverse effects or substantial increase in the severity or intensity of effects on public services.

New Information

There is no new information of substantial importance that would result in an increase in the severity of effects on public services. However, since the publication of the 2001 FEIS, there have been minor changes in the "Affected Environment," which are presented below.

SUMMARY OF ENVIRONMENTAL COMMITMENTS

Environmental commitments are measures incorporated by the project applicant as part of the project, meaning they are proposed as elements of the Proposed Action and are therefore considered in conducting the environmental analysis for each resource area of this SEIS. The purpose of environmental commitments is to reflect and incorporate best practices into the project that avoid, minimize, reduce, or offset potential environmental effects. Since publication of the 2000 RDEIR/EIS, the following environmental commitments related to flood control and levee stability have been added to the project description. These environmental commitments are described in detail in Chapter 2, “Project Description and Alternatives,” of this SEIS. There are no environmental commitments that would affect the analysis or conclusions related to public services.

3.15.2 AFFECTED ENVIRONMENT

POLICE AND FIRE PROTECTION SERVICES

Bacon Island and Bouldin Island

Law enforcement for Bacon Island and Bouldin Island is provided by the San Joaquin County Sheriff’s Department. The department’s headquarters are in French Camp, California. The San Joaquin County Sheriff’s department marine patrol division provides water patrol services to approximately 600 square miles of waterways in the Delta area. The marine patrol unit is staffed by six deputy sheriffs and one supervisor; reserve officers are also used during major events and holidays. The marine patrol division substation, located at Steven’s Anchorage in Stockton, responds to emergencies on the water for Bouldin Island and Bacon Island. Sheriff’s land units respond to emergencies on the islands. Through a mutual aid agreement with San Joaquin County, the Sacramento County Sheriff’s Department, the Contra Costa County Sheriff’s Department, and the U.S. Coast Guard also provide emergency services to Bacon and Bouldin Islands if needed. The San Joaquin County Sheriff’s Department is responsible for law enforcement and investigation in the area regarding, but not limited to, drownings, boat accidents, drunkenness, theft, vandalism, property crimes, trespassing, disturbances, and enforcement of boat speed limits (Malcolm pers. comm., 2008).

Fire protection for Bouldin Island is provided by the Woodbridge Fire District. The Woodbridge Fire District’s service area encompasses approximately 192 square miles. Station 74, located in Lodi, provides fire protection and emergency services to Bouldin Island. Station 74 is staffed by three personnel and equipped with one engine and one fire boat. Volunteer firefighters are also available to respond to fire emergencies as needed. The fire boat is berthed and launched at Tower Park Marina, on Little Potato Slough. Response time from Station 74 to Bouldin Island is approximately 5–8 minutes (Kirkle pers. comm., 2008).

Bacon Island is not in a fire protection district. Fire protection services are the responsibility of the landowners.

Webb Tract and Holland Tract

The Contra Costa County Sheriff’s Department provides law enforcement services for Webb and Holland Tracts. The department’s headquarters are in Martinez. The Contra Costa County Sheriff’s Department Delta marine patrol division provides emergency service to Webb and Holland Tracts through its substation in Oakley. The marine patrol is staffed by two deputy officers year-round; an additional deputy officer is available during the peak summer season (Memorial Day through Labor Day). Contra Costa County has a statewide mutual aid agreement with the San Joaquin County Sheriff’s Department and the U.S. Coast Guard to respond to emergency situations in the Delta.

The East Contra Costa Fire Protection District provides fire protection for Holland Tract. The district is staffed by approximately 48 full-time firefighters and 24 reserve firefighters. The district service area encompasses approximately 260 square miles. Station 94, located in Knightsen, is the closest station to Holland Tract. Response time from Station 94 to Holland Tract is less than 7 minutes. The district has a Class III/VIIII Fire Department Insurance Service Office Rating and operates under a statewide mutual aid agreement with other fire agencies in and around San Joaquin County (Helmick pers. comm., 2008).

Webb Tract is not in a fire protection district. Fire protection is the responsibility of the landowners.

3.15.3 Regulatory Framework/Applicable Laws, Regulations, Plans, and Policies

Federal applicable laws and regulations are provided because they are required under NEPA. State applicable laws and regulations are provided for informational purposes and to assist with NEPA review. USACE has considered applicable state, regional, and local plans and ordinances as a part of the environmental review process for this SEIS, where applicable.

Federal

There are no Federal regulations, plans, or policies that pertain to the Proposed Action or alternatives under consideration.

State

There are no state regulations, plans, or policies that pertain to the Proposed Action or alternatives under consideration.

3.15.4 Analysis Methodology

The analytical approach, effect mechanisms, and significance criteria remain as presented in the 2001 FEIS and are herein incorporated by reference. Potential effects of the Proposed Action and alternatives under consideration on public services were evaluated based on how project operation would affect the ability of the service agencies and existing facilities to adequately serve the Project Islands.

Significance Criteria

The basis for determining the significance of effects for this analysis is based on specific criteria developed by the lead agency to address potential effects unique to the project's location and elements, and is informed by the criteria contained in the Environmental Checklist in Appendix G of the State CEQA Guidelines. These thresholds encompass the factors taken into account under NEPA to determine the significance of an action in terms of its context and the intensity of its effects.

The Proposed Action or alternatives under consideration would have a significant, adverse effect on public services if they would do any of the following:

- result in increased demand for existing emergency services beyond their current capacity.

3.15.5 Environmental Consequences and Mitigation Measures

Effects Analysis

Effects on public services resulting from project implementation were described in the 2001 FEIS (Chapter 3E) and are listed below in Table 3.15-1. Where there have been no changes to the effects analysis or conclusions, the 2001 FEIS is incorporated by reference, and the effects conclusions and mitigation measures are briefly summarized.

No-Action Alternative

EFFECT PS-1 **Increase in Demand for Police Services on the Project Islands.** *Increasing the intensity of agricultural activities would not result in an increase in the demand for police services. No effect would occur.*

As discussed in the 2001 FEIS, implementation of the intensified agricultural activities under the No-Action Alternative would not increase demands on police protection services on the project islands. The small increase in recreational use of the project islands that may occur over time as a result of the proposed for-fee hunting program would not result in a substantial increased demand for emergency services above existing capacities. Thus, there would be **no effect**.

EFFECT PS-2 **Increase in Demand for Fire Protection Services on the Project Islands.** *Increasing the intensity of agricultural activities would not result in an increase in the demand for fire protection services. No effect would occur.*

As discussed in the 2001 FEIS, implementation of the intensified agricultural activities under the No-Action Alternative would not increase demands on fire protection services on the project islands. The small increase in recreational use of the project islands that may occur over time as a result of the proposed for-fee hunting program would not result in a substantial increased demand for emergency services above existing capacities. Thus, there would be **no effect**.

Alternatives 1, 2 (Proposed Action), and 3

The effects analysis and mitigation measures for Alternatives 1, 2, and 3 are the same; therefore, they are described together under this heading.

EFFECT PS-1 **Increase in Demand for Law Enforcement Services on the Project Islands.** *Operation of proposed water diversion and storage facilities would not increase the demand for law enforcement services. No effect would occur.*

The project no longer includes the construction of new recreational facilities. Operation of the proposed water diversion and storage facilities, and/or habitat management activities, would not increase the demand for law enforcement services. Therefore, **no effect** would occur.

Mitigation Measure: No mitigation is required.

EFFECT PS-2 **Increase in Demand for Fire Protection Services on the Project Islands.** *Operation of the proposed water diversion and storage facilities would not increase the demand for fire protection services. No effect would occur.*

The project no longer includes the construction of new recreational facilities. Operation of the proposed water diversion and storage facilities, and/or habitat management activities, would not increase the demand for fire protection services. Therefore, **no effect** would occur.

Mitigation Measure: No mitigation is required.

Table 3.15-1 Comparison of Delta Wetlands Project 2001 FEIS and this SEIS Effects and Mitigation Measures for Public Services	
2001 FEIS Effects and Mitigation Measures	SEIS Effects and Mitigation Measures
Alternatives 1 and 2 (Proposed Action)	
Impact E-8: Increase in Demand for Police Services on the Project Islands (LTS-M) **Mitigation Measure E-3:** Provide Adequate Lighting in and around Buildings, Walkways, Parking Areas, and Boat Berths **Mitigation Measure E-4:** Provide Private Security Services for Recreation Facilities and Boat Docks	**Effect PS-1:** Increase in Demand for Law Enforcement Services on the Project Islands (NI) The effects analysis, conclusion, and mitigation measures have changed because the project no longer includes the construction of recreation facilities.
Impact E-9: Increase in Demand for Fire Protection Services on the Project Islands (LTS-M) **Mitigation Measure E-5:** Incorporate Fire Protection Features into Recreation Facility Design **Mitigation Measure E-6:** Provide Fire Protection Services to Webb Tract and Bacon Island	**Effect PS-2:** Increase in Demand for Fire Protection Services on the Project Islands (NI) The effects analysis, conclusion, and mitigation measures have changed because the project no longer includes the construction of recreation facilities.
Alternative 3	
Impact E-22: Increase in Demand for Police Services on Project Islands (LTS-M) **Mitigation Measure E-3:** Provide Adequate Lighting in and around Buildings, Walkways, Parking Areas, and Boat Berths **Mitigation Measure E-4:** Provide Private Security Services for Recreation Facilities and Boat Docks	**Effect PS-1:** Increase in Demand for Law Enforcement Services on the Project Islands (NI) The effects analysis, conclusion, and mitigation measures have changed because the project no longer includes the construction of recreation facilities.
Impact E-23: Increase in Demand for Fire Protection Services on the Project Islands (LTS-M) **Mitigation Measure E-5:** Incorporate Fire Protection Features into Recreation Facility Design **Mitigation Measure E-6:** Provide Fire Protection Services to Webb Tract and Bacon Island	**Effect PS-2:** Increase in Demand for Fire Protection Services on the Project Islands (NI) The effects analysis, conclusion, and mitigation measures have changed because the project no longer includes the construction of recreation facilities.
Notes: Shading denotes changes in the effect, significance conclusion, or mitigation measure from the 2001 FEIS; NI = No impact Sources: ICF 2010:4.4-2 through 4.4-9 and AECOM 2014	

3.15.6 SECONDARY AND CUMULATIVE IMPACTS

Secondary and cumulative effects on public services from implementing the project were described in the 2001 FEIS (Chapter 3E) and the 2010 DEIR (Chapter 5). The 2001 FEIS and 2010 DEIR are herein incorporated by reference, and the effect conclusions and mitigation measures, along with any changes, are summarized briefly below and shown in Table 3.15-2.

Increase in Demand for Law Enforcement and Fire Protection Services

The project no longer includes the construction of recreation facilities. Therefore, the project would not result in an increase in demand for law enforcement or fire protection services, and would not result a cumulatively considerable contribution to this cumulatively significant effect.

Table 3.15-2
Comparison of Secondary and Cumulative Public Services Effects between the 2001 FEIS and this SEIS

2001 FEIS Cumulative Effects and Mitigation Measures	SEIS Cumulative Effects and Mitigation Measures
Not previously analyzed.	Increased in Demand for Law Enforcement and Fire Protection Services on the Project Islands (NCC)

Notes: Shading denotes changes in the effect, significance conclusion, or mitigation measure from the 2001 FEIS; NCC = Not cumulatively considerable

Source: Data compiled by AECOM in 2014

3.16 SOCIOECONOMICS

3.16.1 INTRODUCTION

The term "socioeconomics" describes basic attributes and resources associated with the human environment, with particular emphasis on population, housing, and employment. Substantial changes in these fundamental socioeconomic indicators may in turn influence related variables such as provision of community services and utilities, and cost of available housing.

Because the 2001 FEIS did not include a section related to socioeconomics, this section of the SEIS is entirely new. This section describes the environmental and regulatory settings for socioeconomics as well as potential environmental consequences and associated mitigation measures, as they pertain to implementing the project. This analysis addresses project-related socioeconomics effects of construction and operation at the four project islands as well as project operation in the places of use. Section 3.8, "Environmental Justice," describes race, ethnic origin, and economic status, and analyzes the potential for the project to result in disproportionately high and adverse effects on minority and low-income populations.

3.16.2 AFFECTED ENVIRONMENT

The affected environment for socioeconomic conditions includes discussion of historic population and housing data, employment and labor force trends, prominent business and industry types, and government and finance. The description of socioeconomic conditions is both qualitative and quantitative, where appropriate.

PROJECT ISLANDS

The project islands can be described in terms of U.S. Census Bureau Census Tract (CT) 3010 in Contra Costa County and CTs 39 and 40.01 in San Joaquin County. Webb Tract and Holland Tract are contained within U.S. Census Bureau Census Tract (CT) 3010 in Contra Costa County. Bacon Island and Bouldin Island are located in CTs 39 and 40.01, respectively, in San Joaquin County. Together, CTs 3010, 39, and 40.01 encompass an area in which construction of discharge and diversion facilities and levee improvements; water storage operations; and implementation of a Compensatory Mitigation Plan (CMP) would have the majority of socioeconomic effects.

Because of the often wide-ranging, interdependent nature of socioeconomic resources, economic effects of the project would be dispersed over a greater geographical area. Therefore, the following discussion includes a description of socioeconomics conditions, including population and housing, for Contra Costa and San Joaquin Counties since these areas would likely contribute goods and services during the construction period. Comparable data for the State of California are also presented below.

Population and Growth Trends

Table 3.16-1 presents historical, current, and projected population trends for Contra Costa and San Joaquin Counties and the state as a whole. This information was obtained from the California Department of Finance (DOF) since it provided the most comprehensive dataset for these geographic areas. Current population data for CTs 3010, 39, and 40.01 were obtained from the 2010 decennial census, as the decennial census is the most recently completed dataset that can be used to show population at the CT level.

As of 2010, the population in Contra Costa and San Joaquin Counties was approximately 1.7 million people. From 2000 to 2010, the Contra Costa County population increased by 10.6%. During this 10-year period, the population of San Joaquin County grew at a greater rate than that of Contra Costa County, with a growth rate of 21.6%. The growth rate between 2000 and 2010 in Contra Costa County (10.6%) was similar to the growth rate of the state as a whole (10.0%).

Table 3.16-1 **Historical, Current, and Projected Population for Contra Costa and San Joaquin Counties and California, 2000 Through 2050**							
	Historic/Current Trends			Projected Conditions			
Location	2000	2010	Percent Change 2000–2010	2020	2030	2050	Percent Change 2010–2050
Contra Costa County	948,816	1,049,025	10.6	1,161,014	1,263,049	1,496,207	42.6
San Joaquin County	563,598	685,306	21.6	795,632	935,709	1,288,854	88.4
State of California	33,871,648	37,253,956	10.0	40,817,839	44,574,756	51,013,984	36.9
Sources: California Department of Finance 2010, 2012a, 2012b							

Population growth projections through 2050 indicate that San Joaquin County is projected to grow at a rate more than double the state's rate of growth (36.9%) with a projected increase of 88.4% from 2010 to 2050. Contra Costa County is projected to experience a growth rate (42.6%) that is greater than the state's projected growth by 2050 (Table 3.16-1).

In 2010, the population of CTs 3010, 39, and 40.01 was 3,659 persons, 1,749 persons, and 2,508 persons, respectively, for a total population of 7,916 persons in the four project islands (U.S. Census Bureau 2010). Therefore, less than 1 percent of the population in Contra Costa and San Joaquin Counties resided in and near the four project islands.

The majority of the population within the affected area resides in the community of Bethel Island within CT 3010 and the communities of Terminous and Thornton in CT 40.01. Approximately 58% of the population within CT 3010 is located within the Bethel Island CDP (2,137 persons) and 68% of the population within CT 40.01 is located within the Terminous and Thornton CDPs (381 persons and 1,131 persons, respectively).

Housing

Table 3.16-2 presents housing trends as well as the percentage of single-family dwellings, vacancy rates, and average household size for Contra Costa and San Joaquin Counties and the State of California as a whole. This information was obtained from DOF while current housing data for CTs 64.05 and 1.02 were obtained from the 2010 decennial census.

Table 3.16-2 **Housing Trends and Characteristics of the Contra Costa and San Joaquin Counties and California, 2000–2010**						
	Trends			Characteristics (2010)		
Location	2000	2010	Percent Change	Single Family (%)	Vacancy (%)	Average Persons per Household
Contra Costa County	354,577	400,263	12.9	74.5	6.2	2.77
San Joaquin County	189,160	233,755	23.6	77.6	8.0	3.12
California	12,214,550	13,670,304	11.9	64.4	5.9	2.96
Sources: U.S. Census Bureau 2010, California Department of Finance 2012b						

In 2010, Contra Costa and San Joaquin Counties contained approximately 634,000 housing units. This total represents approximately 4.6% of the state's housing stock. From 2000 through 2010, Contra Costa and San Joaquin Counties experienced a 12.9% and 23.6%, respectively, increase in the total number of housing units during this 10-year period. During the same time period, the state experienced a 11.9% increase in the total number of housing units.

In addition to housing unit data, Table 3.16-2 lists useful descriptors that characterize housing in the area: the percentage of single-family dwellings, vacancy rates, and average household size. Overall, single-family dwelling units in all the jurisdictions listed in Table 3.16-2 are the predominant housing type and composed more than 64 percent of the housing units. Contra Costa and San Joaquin Counties currently have more single-family housing units as a percentage of the total housing stock than observed at the state level in 2010 (64.4%). Vacancy rates were generally higher than the state average (5.9%), with Contra Costa County having a vacancy rate of 6.22% and San Joaquin County having a vacancy rate of 8.02%. The average persons per household in Contra Costa and San Joaquin Counties (3.16 and 3.23, respectively) were greater than the average persons per household at the state level (2.96 persons).

In 2010, CTs 3010, 39, and 40.01 contained approximately 5,116 housing units (Table 3.16-3). This total represents less than 1% of the housing units in Contra Costa and San Joaquin Counties. Vacancy rates were generally higher than Contra Costa and San Joaquin Counties and the state average. In particular, the vacancy rate for CT 3010 was approximately 26.9%. This high vacancy rate can be largely attributed to vacant seasonal, recreational, or occasional use rental units (U.S. Census Bureau 2010). The average persons per household in CTs 3010 and 40.01 (2.30 and 2.92, respectively) were less than the average persons per household for Contra Costa and San Joaquin Counties and at the state level (2.96 persons).

Table 3.16-3
Housing Characteristics of CT 3010, CT 39, and CT 40.01, in 2010

Location	Housing Units	Vacancy (%)	Average Persons per Household
CT 3010[1]	2,097	26.9	2.30
CT 39[2]	617	4.8	3.08
CT 40.01[3]	921	9.3	2.92
Total	**3,635**	—	—

Notes: CT = Census Tract
[1] CT 3010 is located within Contra Costa County and includes the Holland and Webb Tracts.
[2] CT 39 is located in San Joaquin County and includes Bacon Island.
[3] CT 40.01 is located in San Joaquin County and includes Bouldin Island.
Source: U.S. Census Bureau 2010

Labor Force, Employment, and Industry

Labor force, employment, and industry indicators provide useful insight into an area's economy. A description of industrial makeup provides an aggregate depiction of the types of industries that are established in an area, while identifying major employers illustrates which types of businesses are most successful and represent major employment opportunities for the people of the area. The following discussion describes labor force, recent employment trends, unemployment rates, and industry data.

Information regarding labor force, employment, and industry characteristics described in this section was obtained mainly from the California Employment Development Department (EDD) Labor Market Information division.

The discussion focuses on Contra Costa and San Joaquin Counties, because of the limited economic data available for CTs 3010, 39, and 40.01.

Labor Force

Table 3.16-4 presents the total number of workers in the labor force for Contra Costa and San Joaquin Counties and the State of California as a whole from 1990 to 2010. According to EDD, California had labor force of 18,316,400 in January 2010, which represents an increase of 20.8% over the 20-year period. In total, Contra Costa and San Joaquin Counties had a labor force of 525,300 and 300,800, respectively, in 2010. Therefore, the combined labor force in Contra Costa and San Joaquin Counties accounted for 4.5% of California's total labor force.

Table 3.16-4
Labor Force for Contra Costa and San Joaquin Counties and California, 1990–2010

Location	Number of Workers in Labor Force			Percent Change, 1990–2010
	1990	2000	2010	
Contra Costa County	435,500	500,900	523,300	20.2
San Joaquin County	227,200	258,900	300,800	32.4
Total	**662,700**	**759,800**	**824,100**	**24.3**
State of California	15,168,500	16,857,600	18,316,400	20.8

Source: California Employment Development Department 2010a

In January 2010, EDD reported 523,300 people in the labor force in Contra Costa County; this is an increase of 20.2 percent since 1990. San Joaquin County's labor force increased 32.4% between 1990 and 2010, from 227,200 to 300,800. Overall, Contra Costa and San Joaquin Counties' labor force has increased 14.7% in the 20-year period from 1990 to 2010.

Employment

The U.S. experienced an economic recession that began in late 2007 and became apparent beginning in 2008. Changes to the California and U.S. economies attributable to the recession resulted in increases in unemployment rates statewide. California's unemployment rate has been generally 2.0% greater than the nation's since April 2009, with the difference reaching a high of 3.4% in December 2010. Declines in construction spending and related losses in financial sectors are main contributing factors behind the state's long-term unemployment rates (California Employment Development Department 2012a).

Employment and labor data for the Contra Costa and San Joaquin Counties and the State of California as a whole from 2007 to 2010 are shown in Table 3.16-5. Unemployment rates in both Contra Costa and San Joaquin County and the state have increased over the 4-year period. Unemployment rates in the state registered 5.4% in 2007 and more than doubled by 2010 to 12.4%. Since 2007, unemployment rates in Contra Costa have been consistently less than state trends while unemployment rates in San Joaquin Counties have been substantially higher. In 2010, Contra Costa County registered an unemployment rate of 11.1% and the unemployment rate in San Joaquin County was 17.3%.

Established businesses, along with new businesses that locate in the area, will play an important role in the expansion of the local economy projected by the State. Table 3.16-6 summarizes EDD data regarding the top employers by employee class for Contra Costa and San Joaquin Counties. This list of employers includes a range of businesses with a payroll of over 500 people.

Table 3.16-5
Labor Force and Employment for Contra Costa and San Joaquin Counties and California, 2007 Through 2010

Location	2007		2008		2009		2010	
	Labor Force	Employment[1]	Labor Force	Employment[1]	Labor Force	Employment[1]	Labor Force	Employment[1]
Contra Costa County	515,100	490,900 (4.7%)	524,600	492,200 (6.2%)	525,100	471,600 (10.2%)	523,300	465,100 (11.1%)
San Joaquin County	289,100	265,700 (8.1%)	293,300	262,900 (10.4%)	298,300	252,800 (15.3%)	300,800	248,900 (17.3%)
State of California	17,921,000	16,960,700 (5.4%)	18,203,100	16,890,000 (7.2%)	18,208,300	16,144,500 (11.3%)	18,316,400	16,051,500 (12.4%)

Note:

[1] Unemployment rate in parentheses.

Source: California Employment Development Department 2010a

Table 3.16-6
Top Employers in Contra Costa and San Joaquin Counties, 2012

Contra Costa County	
Employee Class Size Over 5,000	
California State Auto Association	Chevron Corporation
Employee Class Size Over 1,000	
BART	John Muir Medical Center
Chevron Global	Kaiser Permanente
Contra Costa Regional Medical Center	La Raza Market
Doctor’s Medical Center	Saint Mary’s College
Employee Class Size Over 500	
Bayer Health Care Pharmaceutical	Richmond City Offices
Bio-Rad Laboratories	San Ramon Regional Medical Center
Concord Naval Weapons Station	Shell Oil
Department of Veterans Affairs	Sutter Dental Medical Center
Muri Lab	Tesoro Golden Eagle Refinery
Nordstrom	Veterans Outpatient Clinic
San Joaquin County	
Employee Class Size Over 5,000	
Blue Shield of California	
Employee Class Size Over 1,000	
All Handyman Management	Prima Frutta Packaging
Duel Vocational Institute	Safeway Distribution Warehouse
Division of Juvenile Justice	San Joaquin County General Hospital
Lodi Memorial Hospital	Saint Joseph’s Medical Center
North California Youth Center	Waste Management Inc.
O-G Packaging and Cold Storage	Whirlpool Corporation
Pacific Coast Producers	

Table 3.16-6 Top Employers in Contra Costa and San Joaquin Counties, 2012	
Employee Class Size Over 500	
B and B Ranch	San Joaquin County Sheriff's Office
Foster Care Services	Stockton Police Department
Morada Produce Company	Tracy Obstetrics
Picture Me Studios	University of the Pacific
San Joaquin County Human Services	Walmart Super Center
Sources: California Employment Development Department 2013a, 2013b	

The top employers in Contra Costa County include the California State Auto Association and Chevron Corporation, each with 5,000-plus employees. The majority of employers with a payroll of over 1,000 include hospitals and medical clinics as well as a university, an oil company, and a grocer. Other employers with a payroll of over 500 employees include medical clinics and laboratories, a department store, oil companies and refineries, and a weapons station.

The top employer in San Joaquin County is Blue Shield of California, with 5,000-plus employees. Employers with a payroll of over 1,000 include County service offices, hospitals, a correctional facility, fruit and produce packers, and warehousing operations. Other employers with a payroll of over 500 employees include county and city service offices, medical clinics, department stores, and a ranch.

Industry

As stated above, the United States experienced a recession that began in late 2007 and became apparent beginning in 2008. The transportation, warehousing, and utilities; wholesale trade; construction; and manufacturing industries, all experienced a slowdown in job growth between 2007 and 2010. The manufacturing sector lost more than 140,000 jobs or 10% of its workforce in 2008 and 2009 (California Employment Development Department 2012b).

Over a 10-year projection period, California employment is expected to rebound as the economy recovers from prior recessionary job losses. Jobs within the manufacturing sector are expected to rebound as the demand for products rises with the economic recovery, it is anticipated that employment in these industries will grow over the next 10 years. Total nonfarm employment is projected to add more than 2.3 million jobs by 2020. Most of the projected nonfarm job growth is concentrated in five industry sectors: construction (26.2%); educational services (private), health care, and social assistance (25.6%); leisure and hospitality (25.5%); professional and business services (23.3%); and retail and wholesale trades (23.2%) (California Employment Development Department 2012b, 2012c).

Table 3.16-7 shows the industry makeup and growth projection by section for Contra Costa and San Joaquin Counties and for the State of California for EDD industry categories. Four of the top five industries in Contra Costa and San Joaquin Counties were the same. In 2010, government represented the first largest industry in Contra Costa and San Joaquin Counties (17.4% and 20.4%, respectively). Professional and business services and the whole sale and retail trades were the second and third largest industries, respectively, in Contra Costa County followed by educational and health services. In San Joaquin County, the whole sale retail trade was the second largest industry and educational and health services was the third largest industry followed by manufacturing. Leisure and hospitality was the fifth largest industry in both counties.

Industry	Contra Costa County 2010	Contra Costa County 2020	Contra Costa County Percent Change	San Joaquin County 2010	San Joaquin County 2020	San Joaquin County Percent Change	California 2010	California 2020	California Percent Change
Mining and Logging	1,200 (<1%)	1,300 (<1%)	8.3	100 (<1%)	100 (<1%)	0	26,800 (<1%)	28,400 (<1%)	10.4
Construction	47,400 (5.0%)	61,100 (5.6%)	28.9	7,600 (4.0%)	9,800 (4.3%)	28.9	599,800 (4.3%)	706,400 (4.3	26.2
Manufacturing	79,700 (8.4%)	83,400 (7.6%)	4.6	17,600 (9.4%)	18,000 (8.0%)	2.3	1,246,300 (8.9%)	1,246,300 (7.6%)	0.4
Transportation, Utilities, and Warehousing	31,500 (3.3%)	36,700 (3.3%)	16.5	13,800 (7.4%)	18,700 (8.3%)	35.5	466,300 (3.3%)	544,000 (3.3%)	16.7
Wholesale and Retail Trade	142,100 (15.0%)	116,200 (10.6%)	14.4	33,700 (18.0%)	42,900 (19.0%)	27.7	1,979,300 (14.2%)	2,656,800 (16.3%)	23.2
Information	23,600 (2.5%)	24,300 (2.2%)	3.0	2,100 (1.1%)	2,200 (0.9%)	4.8	427,700 (3.1%)	463,100 (2.8%)	8.3
Finance	48,200 (5.1%)	56,300 (5.1%)	16.8	7,700 (4.1%)	8,800 (3.9%)	14.3	760,200 (5.4%)	868,700 (5.3%)	14.3
Professional and Business Services	152,100 (16.0%)	192,000 (17.5%)	26.2	15,400 (8.2%)	19,600 (8.7%)	27.3	2,074,400 (14.9%)	2,558,100 (15.7%)	23.2
Educational and Health Services	136,400 (14.4%)	159,000 (14.5%)	16.6	28,800 (15.3%)	36,500 (16.1%)	26.7	1,788,300 (12.8%)	2,246,400 (13.8%)	25.6
Leisure and Hospitality	85,800 (9.0%)	104,400 (9.5%)	21.7	16,100 (8.6%)	20,200 (8.9%)	25.5	1,501,600 (10.8%)	1,884,900 (11.5%)	25.5
Other Services	35,000 (3.7%)	38,900 (3.5%)	11.1	6,500 (3.5%)	8,000 (3.5%)	23.1	484,900 (3.5%)	551,400 (3.4%)	13.7
Government	165,300 (17.4%)	178,200 (16.2%)	7.8	38,200 (20.4%)	41,500 (18.3%)	8.6	2,448,400 (17.5%)	2,548,800 (15.6%)	4.1
Total Non-Farm	**948,300**	**1,097,800**	**15.8**	**187,700**	**226,300**	**20.6**	**13,961,700**	**16,333,100**	**17.0**
Farm Employment	1,400 (<1%)	1,600 (<1%)	12.5	15,700 (8.4%)	16,400 (7.2%)	4.3	382,800 (2.4%)	388,500 (2.1%)	1.5

Table 3.16-7
Industrial Makeup and Growth Projections by Sector for Contra Costa and San Joaquin Counties and California, 2010-2020

Notes: Numbers in parentheses indicate the share as a percentage of the total employment. Percentages may not add to 100% if employment for specific industries in a county is excluded due to nondisclosure rules.

Sources: California Employment Development Department 2012c, 2012d, 2012e

Between 2010 and 2020, San Joaquin County is expected to have a greater increase in non-farm jobs (20.6%) compared to Contra Costa County (15.8%) and the state (17.0%). Contra Costa County is expected to have an increase in farm jobs (14.3%) at a rate of more than three times that of San Joaquin County (4.5%) and more than nine times that of the state (1.5%).

As shown in Table 3.16-7, projections of future job growth in Contra Costa and San Joaquin Counties coincide in many ways with the industrial composition of the state as a whole, but they do vary in some respects. Similar to the state, future job growth in construction, educational and health services, leisure and hospitality-related industries, and professional and business services are expected to substantially increase in Contra Costa and San Joaquin Counties. The construction industry is expected to be the fastest growing industry in the state at a rate of 26% and the construction industry is expected to grow at a slightly greater rate in in both Contra Costa and San Joaquin Counties (over 28% in both counties). Educational and health services are expected to increase by more than 25% in both the state and San Joaquin County. The leisure and hospitality-related industries are expected to grow substantially in the state (25.5%) as well as Contra Costa County and San Joaquin Counties (21.7% and 25.5%, respectively). Professional and business services are anticipated to increase by more than 20% in the state and more than 26% in both Contra Costa County and San Joaquin Counties.

In both San Joaquin County and the state, the wholesale and retail trade industry is expected to grow by more than 27% and 23%, respectively, but it is not in the top growth industries of Contra Costa County. Although transportation, warehousing, and utilities are the fastest growing industries in San Joaquin County with an expected growth rate of more than 35%, these industries are not identified as a top growth industry in Contra Costa County or the state (both at slightly more than 16%). Manufacturing in Contra Costa and San Joaquin Counties is expected to grow at more than five times the state rate. In addition, government is expected to grow at more than twice the state's rate in Contra Costa and San Joaquin Counties.

Table 3.16-8 shows the total industry earning from all industrial sectors listed above as well as personal income, which provides a measure of consumer consumption. Total personal income consists of total earnings, adjusted for place of residence, plus dividends, interest and rent, and transfer payments received by the residents. In 2010, the industrial earning for Contra Costa and San Joaquin Counties was $29,351,680 and $12,206,667, respectively, for a total of $41,558,347 in industrial earnings (U.S. Bureau of Economic Analysis 2012).

Table 3.16-8
Total Industry Earning and Personal Income, 2010

County	Total Industry Earnings [1]	Personal Income (Dollars)		
		Non-Farm	Farm	Total Personal Income
Contra Costa	$29,351,680	$57,663,306	$37,092	$57,700,398
San Joaquin	$12,206,667	$20,244,738	$557,433	$20,802,181
Total	**$41,558,347**	**$77,908,044**	**$594,525**	**$78,502,579**

Notes:

[1] Total industry earnings include all earnings from the industrial sections shown in Table 3.16-7.

Source: U.S. Bureau of Economic Analysis 2012

The total personal income in Contra Costa County ($57,700,398) was more than double the total personal income in San Joaquin County ($20,802,181). In Contra Costa County, the personal income associated with farm employment ($37,092) represented less than 1% of the total personal income in the county ($57,663,306), while in San Joaquin County the personal income associated with farm employment ($557,433) represented approximately 2.8% of the total personal income in the county ($20,244,738) (U.S. Bureau of Economic Analysis 2012).

Agricultural-Related Economics

The Delta farmlands support a variety of crops, including grains, fruits, field crops, nuts, seeds, alfalfa, and vegetables. Other agricultural uses include dairies, livestock grazing, agricultural industrial uses, agricultural commercial uses, and farm-based tourism (e.g., hunting, fishing, wildlife study, educational experiences, festivals, tours, wine-tasting rooms, inns, and "pick-your-own" operations).

The most consistent and generally reliable sources of agricultural production in the region are the annual County Agricultural Commissioner's Reports. These reports are prepared in coordination with the California Agricultural

Statistical Service and National Agricultural Statistics Service, and data collection methods follow generally accepted procedures. The following discussion presents details of agricultural production in Contra Costa and San Joaquin Counties. The profile describes the dominant commodities and sources of revenue to the agricultural sector for each county for 2010.

In Contra Costa County, the total gross valuation for all agricultural commodities produced in 2011 was approximately $92.9 million, which represents an increase of 16.7% from the 2010 production values. Cattle and calves was the largest agricultural commodity in Contra Costa County with a value of $16.3 million followed by sweet corn ($14.0 million), tomatoes ($6.9 million), field corn ($6.7 million), and grapes ($6.0 million) (Contra Costa County 2011). The major factors contributing to the increase in total value from the 2010 crop year were substantial increases in hay and field corn crop acreages and increases in the price of hay, cattle, and field corn.

The total gross valuation for all agricultural commodities produced in San Joaquin County in 2011 was estimated at an all-time high of approximately $2.2 billion, which represents a 14.2% increase from the 2010 production values. Milk and milk products was the largest agricultural commodity in San Joaquin County with a value of $452.9 million followed by grapes ($286.2 million), walnuts ($278.9 million), almonds ($187.7 million), and tomatoes ($107.8 million) (San Joaquin County 2011).

Agricultural Crops and Production Values on the Project Islands

Agriculture is the primary economic activity on the four project islands, comprising an estimated 79 percent of the islands' total acreage in 2008. Corn is grown on Bacon and Bouldin Islands and Webb Tract. In addition, Bacon Island, which is the most intensively farmed of the four project islands, produces wheat, alfalfa, oats, and sunflower and Bouldin Island produces rice and tomatoes. Holland Tract is the least intensively farmed island of the four project islands and is used only for pasture. Table 3.16-9 shows countywide harvested acreage, crop yields, total yield, value per ton, and total crop values for each crop grown on the four project islands using 2010 countywide yield data from Contra Costa and San Joaquin Counties. Tomatoes represent the highest value crop ($115.7 million) on the project islands followed by alfalfa ($51.7 million) and corn ($42.7 million).

The analysis for this SEIS is based on updated (2008) cropping patterns used in the 2010 DEIR analysis, which have not substantially changed since that time. Yield, production levels, and total production value for the crops grown on the project islands are shown in Table 3.16-10. Crop yields and total production values for Webb Tract and Holland Tract in Contra Costa County and for Bacon Island and Bouldin Island in San Joaquin County were estimated using 2010 countywide data shown on Table 3.16-9, above. Although oats and sunflowers were also grown on Bacon Island in 2010, production estimates are not presented in Table 3.16-10 because these crops were not included in the 2010 crop report for San Joaquin County. Thus, the total crop value shown in Table 3.16-10 would be somewhat greater. In 2010, Bouldin Island had the greatest total crop values ($5.5 million) followed by Bacon Island ($3.6 million). The project islands included a total of 16,741 acres of crops, a total yield of 74,519 tons, and a production value of $12.1 million in 2010.

Agricultural operations on the project islands generate direct, indirect, and induced employment in the local and regional economy. Direct employment is generated on the project islands through crop-related cultivation and harvesting activities. The expenditures on goods and services related to on-site agricultural operations indirectly generate additional employment in businesses supplying goods and services. Employment is also induced throughout the region as a result of consumer spending by employees who are directly and indirectly affected by onsite agricultural operations. Agricultural use of the four islands generates an estimated 192 direct, indirect, and induced jobs in San Joaquin and Contra Costa Counties.

Table 3.16-9
Total Production Value of Agricultural Commodities by County, 2010

Crop	Harvested Acreage	Yield (tons per acre)	Total yield (ton)	Value per Ton	Total Value
Contra Costa County[1]					
Corn (grain)	6,380	4.09	26,100	$174	$4,541,000
Pasture[2]	169,000	N/A	N/A	$175	$1,003,000
San Joaquin County					
Corn (grain)	46,200	5.28	244,000	$175	$42,700,000
Wheat	29,600	3.34	99,100	$167	$16,509,000
Alfalfa	59,800	6.50	389,000	$133	$51,737,000
Rice	7,170	3.55	22,600	$340	$7,684,000
Tomatoes	34,800	35.40	1,232,000	$94	$115,712,000

Notes:

1 Because Webb Tract and Holland Tract are located in Contra Costa County, total production values for crops produced on those tracts are based on 2010 countywide yield data from Contra Costa County.

2 The 2011 Contra Costa County Annual Crop and Livestock Report did not include crop yields and total yield for pasture.

Sources: Contra Costa County 2011, San Joaquin County 2011

Government and Finance

This section provides background information on local government and recent financial trends. Local governments provide a wide range of services. Using a mix of funding sources, local officials allocate financial resources for a diverse collection of activities, including providing police and public safety, development review, and educational services in their jurisdictions. The two largest sources of revenue for most local jurisdictions are property taxes and funding from the Federal and state governments. These two sources provide a relatively stable revenue base for funding important local programs. Public health and safety and social services of various forms represent the two biggest expenditures at the local level. These programs serve as a safety net for the local population and are frequently the most visible local programs.

The discussion of the local governments below focuses on Contra Costa and San Joaquin Counties, because of the limited economic data available for their constituent cities and CTs 39, 40.01, and 3010. In many cases, cities and towns work with and share funding with their appropriate county governments. Consequently, county data provide an adequate amount of detail for the area. Information pertaining to government and finance for Contra Costa and San Joaquin Counties described below was obtained from the California State Controller's Office.

Contra Costa County

Contra Costa County provides a wide range of services to its almost 1.1 million residents. To meet residents' needs, Contra Costa County employs a number of funding mechanisms, including property taxes, Federal and state funding, permit fees, and other sources, as shown in Table 3.16-11.
Through these various sources, Contra Costa County generated nearly $1.35 billion in total revenues in the 2009–2010 fiscal year. This total represented a decrease of 2.2% over the 2008-2009 fiscal year revenues of $1.38 billion. In the 2009–2010 fiscal year, the largest source of revenue was Federal and state funding, with more than $693 million. Property taxes represented another large revenue source for Contra Costa County, at more than $315 million (California State Controller's Office 2012).

Table 3.16-10
Estimated Crop Yields and Total Production Values on the Project Islands, 2010

Crops[1]	Bacon Island				Webb Tract[2]				Bouldin Island				Holland Tract[3]				All Islands		
	Acres Planted	Yield (tons per acre)	Total Yield (tons)	Total Crop Value	Acres Planted	Yield (tons per acre)	Total Yield (tons)	Total Crop Value	Acres Planted	Yield (tons per acre)	Total Yield (tons)	Total Crop Value	Acres Planted	Yield (tons per acre)	Total Yield (tons)	Total Crop Value	Acres Planted	Total Yield (tons)	Total Crop Value
Wheat	578	3.34	1,930	$335,820													578	1,930	$335,820
Corn (grain)	1,914	5.28	10,106	$1,768,550	4,064	4.09	16,622	$2,892,228	4,002	5.28	21,131	$3,697,848					9,980	47,859	$8,358,626
Alfalfa	1,787	6.50	11,616	$1,544,928													1,787	11,616	$1,544,928
Rice									623	3.55	2,211	$751,740					623	2,211	$751,740
Tomatoes									308	35.40	10,903	$1,024,882					308	10,903	$1,024,882
Oats	207[4]	N/A	N/A	N/A													207	N/A	N/A
Sunflower	374[4]	N/A	N/A	N/A													374	N/A	N/A
Pasture													2,884	N/A	N/A	$51,912	2,884	N/A	$51,912
Total	**4,860**	--	**23,652**	**$3,649,298**	**4,064**	--	**16,622**	**$2,892,228**	**4,933**	--	**15,225**	**$5,474,470**	**2,884**	--	--	**$51,912**	**16,741**	**74,519**	**$12,067,908**

Notes: N/A = not applicable

1 Crop types and acreages are based on 2010 data shown in Table 3.2-2 of Section 3.2, “Agricultural Resources.” Estimates of total yield and total crop values is based on 2010 Contra Costa and San Joaquin Counties’ crop data and factors shown in Table 3.16-11.

2 Yield factors for corn on Webb Tract are based on Contra Costa County agricultural data.

3 Acreage and yield shown here includes production of acreage that would be excluded from the project under Alternatives 1 and 2.

4 Although oats and sunflower were also grown on Bacon Island in 2010, production estimates are not presented here because these crops were not included in the 2010 crop report for San Joaquin County.

Sources: ICF 2010: 4.8-41 based on Delta Wetlands Properties 2008; Contra Costa County 2011; San Joaquin County 2011; adapted by AECOM in 2013 and 2014

Table 3.16-11 Revenues and Expenditures in Contra Costa County 2007–2010			
	Revenues and Expenditures ($)		
	FY 2007–2008	FY 2008–2009	FY 2009–2010
Revenues			
Property Taxes	315,066,262	313,817,979	290,377,743
Other Taxes	23,185,048	21,345,368	21,215,899
Licenses, Permits, Fines, Forfeitures	83,476,728	56,256,165	43,496,818
Federal, State, Other	693,117,883	644,059,860	717,436,533
Charges for Other Services	245,515,319	250,984,304	252,043,455
Total Miscellaneous Revenue	32,277,555	31,211,681	28,322,877
All Other FinancingSources	9,072,340	23,671,133	121,722
Total Revenue	**1,404,701,155**	**1,341,346,490**	**1,353,015,047**
Expenditures			
Legislative and Administrative, Finance, and Counsel	137,390,094	126,813,302	97,073,319
Police Protection, Corrections, Fire	379,029,663	376,586,114	365,450,158
Public Ways and Facilities	133,122,931	111,119,818	92,977,228
Public Health, Medical Care	198,165,526	211,718,808	215,420,824
Welfare, Social Services, and Other Public Assistance	397,081,762	395,111,548	381,349,339
Total Education	26,224,904	27,068,757	25,437,597
Total Recreation Facilities	--	--	--
Costs Associated with Long-Term Debt (Principal and Interest)	68,970,337	66,497,729	65,698,230
Transfers Out	62,120,353	61,349,686	47,216,642
Total Expenditures	**1,402,105,570**	**1,376,265,762**	**1,290,623,337**
Sources: California State Controller's Office 2009, 2011, 2012			

Similar to total revenues, Contra Costa County's total expenditures decreased between the 2007–2008 fiscal year and the 2009–2010 fiscal year. Expenditures in the 2007–2008 fiscal year totaled more than $1.40 billion, compared to $1.29 billion spent in the 2009–2010 fiscal year (a 7.9 percent decrease) as a result of decreased spending in all categories. Police, fire, and other public safety activities have consistently been the largest expenditure for Contra Costa County (more than $365.5 million in the 2009–2010 fiscal year). Welfare, social services, and other public assistance represented the second largest expenditure category, with more than $381.3 million in the 2009–2010 fiscal year. Total revenues exceeded total expenditures in the 2007–2008 and 2009–2010 fiscal years, while total revenues were more than total expenditures in the 2008–2009 fiscal year.

San Joaquin County

Because of its smaller population, San Joaquin County's total revenues are substantially less than those of Contra Costa County ($816.8 million in the 2009–2010 fiscal year, compared to $1.38 billion in Contra Costa County) (Table 3.16-12). San Joaquin County experienced an overall decrease in revenue growth between 2007 and 2010. In that 3-year period, San Joaquin County's total revenue decreased from $881.9 million in the 2007–2008 fiscal

Table 3.16-12 Revenues and Expenditures in San Joaquin County 2007–2010			
	Revenues and Expenditures (Dollars)		
	FY 2007–2008	FY 2008–2009	FY 2009–2010
Revenues			
Property Taxes	213,840,839	202,999,709	182,672,124
Other Taxes	31,769,348	25,400,906	21,269,185
Licenses, Permits, Fines, Forfeitures	27,960,320	22,871,865	18,526,793
Federal, State, Other	514,672,119	512,587,169	510,242,398
Charges for Other Services	72,428,095	78,315,617	74,756,029
Total Miscellaneous Revenue	15,041,459	12,797,721	9,318,927
All Other Financing Sources	--	--	--
Total Revenue	**881,993,117**	**854,972,986**	**816,785,456**
Expenditures			
Legislative and Administrative, Finance, and Counsel	78,476,399	61,442,864	49,752,254
Police Protection, Corrections, Fire	261,727,526	273,305,952	276,446,207
Transportation, Airport	45,312,952	47,122,975	29,158,141
Public Health, Medical Care	114,654,537	118,873,531	107,633,551
Welfare, Social Services, and Other Public Assistance	328,838,185	333,567,760	342,799,168
Total Education	6,828,828	5,877,855	6,734,444
Total Recreation Facilities	5,191,669	6,062,843	6,024,635
Costs Associated with Long-Term Debt (Principal and Interest)	14,039,806	13,634,178	8,688,989
Transfers Out	47,493,966	25,841,614	31,219,103
Total Expenditures	**902,563,868**	**885,729,572**	**858,456,492**

Note: FY = fiscal year

Sources: California State Controller's Office 2009, 2011, 2012

year to $816.8 million in the 2009–2010 fiscal year, a 7.4 percent decrease. Federal and State funding sources made up the largest revenue source in the 2009–2010 fiscal year, with more than $510.2 million. As seen in San Joaquin County, property taxes represent another substantial revenue source ($182.7 million in the 2009–2010 fiscal year).

Expenditures in San Joaquin County decreased from $902.6 million in the 2008–2009 fiscal year to $858.5 million in the 2009–2010 fiscal year, a 4.9% decrease. The top two expenditures in San Joaquin County in the 2009–2010 fiscal year were welfare and social service programs ($342.8 million) and police, fire, and other public safety programs ($276.4 million). Total expenditures were more than total revenues during all three fiscal years.

Places of Use

The specific places of use (POU) for project water consist of the following water districts:

- Semitropic Water Storage District (Semitropic) in Kern County;

- Metropolitan Water District of Southern California (Metropolitan) and the service areas of its member agencies in Kern, Los Angeles, Orange, Riverside, San Bernardino, San Diego, and Ventura Counties;
- Western Municipal Water District (Western) of Riverside County; and
- Golden State Water Company (Golden State) systems and communities in Los Angeles, Orange, San Luis Obispo, Santa Barbara, and Ventura Counties.

The project water would be used to improve water supply reliability for the Semitropic, Metropolitan, Western, and Golden State water users, which include irrigation, domestic, and municipal and industrial beneficial uses.

The POU represent an area where the economic effects of the project water would be dispersed over a greater geographical area and would be less discernible to a single jurisdiction. As such, the discussion of socioeconomic conditions focuses on a nine-county area that includes Kern, Los Angeles, Orange, Riverside, San Bernardino, San Diego, San Luis Obispo, Santa Barbara, and Ventura Counties, with some aspects of existing socioeconomic conditions combined.

Population and Housing

Table 3.16-13 presents 2010 population and the projected population trends in each of the nine POU counties and in the state. As of 2010, population in the nine counties totaled approximately 22 million people. This population represents approximately 60% of the total state population (approximately 37.2 million residents). Los Angeles County and San Diego County are the two largest counties in the area, with approximately 9.8 million and 3.1 million residents, respectively, in 2010. The smallest counties in the area were San Luis Obispo and Santa Barbara Counties, with 269,637 residents and 423,985 residents, respectively, in 2010.

The total average population growth for 2050 in the nine POU counties is projected to increase by approximately 32.7%. Six of the nine counties are expected to grow at a slower rate than the state (36.9% increase) between 2010 and 2050. Kern County's population is projected to increase by 117.2% and would comprise the greatest population growth rates among the nine counties. This high rate of growth is expected to alter the existing character of Kern County by making it more urban (i.e., with higher density housing and increased demand for public services). Santa Barbara County is projected to experience the least population growth of the nine counties through 2050, at approximately 18.3%.

In addition to population estimates and trends, Table 3.16-13 shows the distribution of housing units, the percentage of single-family dwellings, vacancy rates, and average household size in each of the nine counties in places of use and in the state. As of 2010, the counties of the nine counties had a total of approximately 7.7 million housing units, representing 55% of the total number of housing units in the state (approximately 14 million). The highest number of housing units occurred in Los Angeles County, which also had the highest population. Conversely, San Luis Obispo and Santa Barbara Counties, which had the smallest populations, also had the fewest number of housing units (117,315 units and 281,703 units, respectively).

Overall, single-family housing makes up the largest proportion of the total housing stock in the nine-county area, ranging from 56.5% in Los Angeles County to 75.8% in Ventura County. San Luis Obispo County had the highest housing unit vacancy rate at 13.0%, with Riverside County having the smallest housing unit vacancy rate of the nine counties at 2.71%. Ventura County (5.3%), Orange County (5.4%), and Los Angeles County (5.9%) had vacancy rates similar to the state (5.9%). Households in Riverside County (2.71 persons) were the smallest, on average, in the nine-county area, while Kern and San Bernardino Counties had the largest household sizes (3.15 persons and 3.26 persons, respectively) in 2010.

Table 3.16-13
Population and Housing Data and Projections for Counties in the Places of Use

Location	County									POU Area Total	State of California
	Kern	Los Angeles	Orange	Riverside	San Bernardino	San Diego	San Luis Obispo	Santa Barbara	Ventura		
2010 Total Population	839,631	9,818,605	3,010,232	2,189,641	2,035,210	3,095,313	269,637	423,985	823,318	22,505,572	37,253,956
2020 Projected Population	1,041,469	10,500,679	3,220,788	2,626,222	2,283,798	3,391,010	290,132	448,986	855,196	24,658,280	40,817,839
2030 Projected Population	1,276,155	11,138,280	3,385,762	3,145,948	2,588,990	3,665,358	311,388	469,070	956,324	26,937,275	44,574,756
2050 Projected Population	1,823,277	11,567,915	3,565,648	4,137,882	3,159,003	4,081,292	344,805	501,283	1,085,882	29,855,863	51,013,984
Percent Change, 2010–2050	117.2	17.8	18.5	88.9	55.5	31.9	27.9	18.3	31.9	32.7	36.9
Total Housing Units, 2010	284,367	3,443,087	1,046,118	555,932	699,637	1,164,028	117,315	152,834	281,703	7,744,391	13,670,304
Percent Single-Family	73.4	56.5	65.1	70.1	74.8	60.8	73.3	65.5	75.8	68.4	64.4
Vacancy	10.5	5.9	5.4	7.6	12.6	6.7	13.0	7.0	5.3	8.2	5.9
Average Persons/ Household	3.15	2.98	2.99	2.71	3.26	2.75	2.78	2.86	3.05	2.95	2.96

Note: POU = Places of Use
Sources: California Department of Finance 2012a, 2012b

Labor Force, Employment, and Industry

The following discussion describes labor force, recent employment trends, unemployment rates, and industry data for the nine counties in the places of use.

Labor Force and Employment

The counties within the places of use maintain a labor force of more than 11.0 million people, representing approximately 60% of the labor force of the State of California (18.3 million). In 2010, Los Angeles County maintained the largest labor force of the nine counties, with more than 4,900,000 people (Table 3.16-14). San Luis Obispo County, with only 138,300 people, maintained the smallest labor force.

Table 3.16-14
Labor Force and Employment for Counties in the Places of Use, 2007 Through 2010

Location	2007		2008		2009		2010	
	Labor Force	Employment[1]	Labor Force	Employment[1]	Labor Force	Employment[1]	Labor Force	Employment[1]
Kern	345,700	317,400 (8.2%)	859,700	324,500 (9.8%)	363,200	311,100 (14.4%)	373,700	314,300 (15.9%)
Los Angeles	4,872,500	4,625,600 (5.1%)	4,870,500	4,566,000 (6.3%)	4,888,600	4,337,900 (11.3%)	4,911,900	4,294,200 (12.6%)
Orange	1,608,600	1,546,200 (3.9%)	1,618,400	1,533,100 (5.3%)	1,592,500	1,441,500 (8.9%)	1,592,500	1,441,500 (9.5%)
Riverside	903,400	848,900 (6.0%)	912,900	835,200 (8.5%)	917,000	794,300 (13.4%)	938,400	802,300 (14.5%)
San Bernardino	863,500	815,100 (5.6%)	863,500	794,600 (8.0%)	858,700	747,700 (12.9%)	861,500	739,400 (14.2%)
San Diego	1,517,600	1,448,500 (4.6%)	1,548,600	1,455,900 (6.0%)	1,554,900	1,405,600 (9.6%)	1,574,100	1,408,200 (10.5%)
San Luis Obispo	134,200	128,500 (4.3%)	136,600	128,800 (5.7%)	136,400	124,100 (9.0%)	138,300	124,600 (9.9%)
Santa Barbara	213,800	204,500 (4.4%)	218,500	206,600 (5.4%)	220,000	201,500 (8.4%)	222,600	201,700 (9.4%)
Ventura	423,700	403,000 (4.9%)	429,500	402,700 (6.3%)	430,500	388,100 (9.9%)	435,200	388,100 (10.8%)
State of California	17,921,000	16,960,700 (5.4%)	18,203,100	16,890,000 (7.2%)	18,208,300	16,144,500 (11.3%)	18,316,400	16,051,500 (12.4%)

Note:

[1] Unemployment rate in parentheses.

Source: California Employment Development Department 2010b

In 2007, all but Kern County had unemployment rates similar to or less than the state. As shown in Table 3.16-14, unemployment rates within the nine-county area have steadily increased over the 4-year period. Three counties—Kern, Riverside, and San Bernardino—registered higher unemployment rates than the state as a whole in 2010, with rates of 15.9, 14.5, and 14.2%, respectively. Los Angeles County had an unemployment rates (12.6 percent) similar to the state's unemployment rate of 12.4%. Orange, San Diego, San Luis Obispo, Santa Barbara, and Ventura Counties registered unemployment rates below state levels, with Santa Barbara County registering the lowest unemployment rate (9.4%) in 2010.

Industry

As shown in Table 3.16-15, business and industry in the POU area is composed primarily of five industries: educational and health services; professional and business services; retail trade; leisure and hospitality; and manufacturing. These industries consistently rank in the top five industries of the POU counties. The education and health services industry, which consists of industries such as elementary and secondary schools, colleges and universities, medical offices, hospitals, and nursing care facilities, was the leading industry in all counties. Retail trade ranks in the top three industries in six of the nine counties and the leisure and hospitality industry is another common industry in the nine-county area. In only Ventura County did the leisure and hospitality industry not rank as one of the top five industries. Agriculture ranked as a top industry in only Kern County and construction was a top industry only in San Luis Obispo County. Manufacturing ranked as a top five industry in in all counties with the exception of San Luis Obispo County.

Table 3.16-15
Top Five Industries in Each County in the Places of Use, 2010

Kern	Los Angeles	Orange	Riverside	San Bernardino	San Diego	San Luis Obispo	Santa Barbara	Ventura
Educational & Health Services (19.6%)	Educational & Health Services (20.2%)	Educational & Health Services (18.2%)	Educational & Health Services (20.1%)	Educational & Health Services (21.9%)	Educational & Health Services (20.4%)	Educational & Health Services (22.3%)	Educational & Health Services (23.4%)	Educational & Health Services (18.6%)
Agriculture (14.5%)	Professional & Business Services (12.1%)	Professional & Business Services (13.9%)	Retail Trade (12.9%)	Retail Trade (12.8%)	Professional & Business Services (14.2%)	Retail Trade (12.9%)	Professional & Business Services (11.5%)	Professional & Business Services (12.4%)
Retail Trade (11.1%)	Manufacturing (11.2%)	Manufacturing (13.6%)	Leisure & Hospitality (10.9%)	Manufacturing (10.3%)	Retail Trade (11.0%)	Leisure & Hospitality (11.4%)	Leisure & Hospitality (11.1%)	Retail Trade (11.0%)
Leisure & Hospitality (8.4%)	Retail Trade (10.6%)	Retail Trade (10.9%)	Professional & Business Services (9.9%)	Leisure & Hospitality (8.5%)	Leisure & Hospitality (10.8%)	Professional & Business Services (11.2%)	Retail Trade (9.8%)	Manufacturing (10.6%)
Professional & Business Services (8.2%)	Leisure & Hospitality (9.9%)	Leisure & Hospitality (9.7%)	Manufacturing (9.4%)	Professional & Business Services (8.4%)	Manufacturing (9.3%)	Construction (7.1%)	Manufacturing (7.8%)	Finanace & Insurance (8.7%)

Note: Numbers in parentheses indicate the share as a percentage of the total employment.

Source: U.S. Census Bureau 2011

Government and Finance

Total revenues and expenditures vary substantially between the nine counties of the places of use because of the relative sizes of the counties and the services they provide. Over 240 incorporated cities and a multitude of unincorporated communities are located within these nine counties. This collection of governmental entities provides valuable public services, including education, fire protection, employment development, emergency services, and crime prevention and control. These agencies and special districts rely primarily on tax revenue disbursed by state government, local sales and property taxes and fees, and the disbursement of Federal funds.

Public health and safety and social services of various forms generally represent the two biggest expenditures at the local level. These programs serve as a safety net for the local population and are frequently the most visible local programs.

3.16.3 Regulatory Framework/Applicable Laws, Regulations, Plans, and Policies

Federal

There are no Federal laws, regulations, plans, or policies related to socioeconomics that would apply to the Proposed Action or alternatives under consideration.

State

There are no state laws, regulations, plans, or policies related to socioeconomics that would apply to the Proposed Action or alternatives under consideration.

3.16.4 Analysis Methodology

This socioeconomic analysis focuses on changes in economic conditions that would occur in Contra Costa and San Joaquin Counties and the POU from implementation of the project. Where possible, a quantitative comparison was used to determine the economic effects of the project on future conditions. The following discussion provides the methodology used to evaluate effects of the project on population and housing, employment and income, and fiscal conditions.

Population and Housing

The examination of population and housing conditions is based on information obtained from the DOF and the U.S. Census Bureau's 2010 decennial census since those sources provide the most comprehensive dataset for the project islands.

Population effects were evaluated based on changes to population from temporary and permanent residents associated with construction, operation, and maintenance activities. Housing effects were assessed based on estimated housing needs resulting from population changes expected as a result of the project's construction, operation, and maintenance activities.

Employment and Income

Evaluation of potential employment and income effects that would result from project implementation were identified based on a review of data and documents pertaining to the project islands and Contra Costa and San Joaquin Counties, including the EDD and the U.S. Bureau of Economic Analysis employment and labor force databases, the Assessment of Economic And Fiscal Effects of Idling Farmland In Contra Costa And San Joaquin Counties For Proposed Water Transfers (TCW Economics 2009), the Economic Effects of Temporary Land Idling for Temporary Water Transfers (RMecon 2002), and information provided in the 2001 FEIS.

This analysis considers "direct" employment and income generated by individual alternatives as well as "indirect and induced" employment and income that would be created by construction-related and operation- and maintenance-related activities. Indirect employment may support hiring in businesses that provide materials to the construction effort; in service-related industries that provide food, beverages, and other goods to construction workers and nonlocal visitors to the project islands; or in more technical industries, such as consulting firms and other businesses. Induced employment consists of jobs that would be created in the region due to increased household spending, and is not limited to construction-related and operation- and maintenance-related activities.

Agricultural-Related Effects

The analysis of agricultural-related effects this SEIS is based on updated (2008) cropping patterns used in the 2010 DEIR analysis, which have not substantially changed since that time. Baseline agricultural production value and acreage data was obtained from the 2010 Contra Costa County and the San Joaquin County crop reports (Contra Costa County 2011, San Joaquin County 2011). The analysis of crop related estimation factors for the direct agricultural effects of land idling uses the crop budget information and the indirect and induced effects within counties of land idling and water transfer payments. Indirect effects result from expenditures in the region by regional industries, and include purchases of inputs to grow crops. Induced effects are caused by the expenditure of household income.

The economic analysis relies on multipliers that measure changes in economic variables per acre of idled farmland (i.e., the net value of offsetting water-transfer payment effects). These multipliers were derived from multipliers developed for an assessment of water transfer effects prepared for the California Department of Water Resources for idling farmland in California's Central Valley (RMecon 2002). The multipliers were originally produced by IMPLAN, an input-output database and modeling routine, supplemented with information from University of California Cooperative Extension crop budgets. Multipliers for this analysis, representing the combined direct, indirect, and induced effects, were developed for value added (i.e., wages and salaries as well as proprietor's and property incomes, dividends and interest, and indirect business taxes), wages and salaries, and employment.

Fiscal Effects

Fiscal effects of water transfers considered in this analysis consisted of changes in property tax and sales tax revenues for Contra Costa and San Joaquin Counties from construction, operation, and maintenance of the water storage facilities.

SIGNIFICANCE CRITERIA

Under NEPA, economic or social effects must be discussed if they are interrelated to the natural or physical environmental effects of a project (40 Code of Federal Regulations 1508.14). Since economic effects of the project are related to the physical environmental effects of the project, a socioeconomics analysis is required. Economic effects discussed in this section are not considered physical effects on the environment; however, economic effects can be used to judge the significance of physical effects. For this analysis, the magnitude of economic effects resulting from project implementation were identified and used to help characterize the socioeconomic effects resulting from the conversion of the project islands to water storage facilities and implementation of the proposed CMP.

The basis for determining the significance of effects for this analysis is based on professional standards and project-specific criteria developed by the lead agency to address potential effects unique to the project's location and elements. These thresholds encompass the factors taken into account under NEPA to determine the significance of an action in terms of its context and the intensity of its effects. An alternative is considered to have an adverse effect on socioeconomics if it would:

- produce a substantial burden on the existing housing stock within the local community because of an increased housing demand created by nonlocal project employees;
- displace substantial numbers of people or housing, necessitating the construction of replacement housing elsewhere;
- require sizeable numbers of new workers in a particular industrial sector from outside the local area during construction or operation;

- cause a substantial decrease in the number of opportunities for temporary or long-term direct, indirect, or induced employment, including agricultural-related employment opportunities;
- cause a substantial decrease in the number of opportunities for temporary or long-term increases in personal and/or disposable incomes; or
- cause a substantial decrease in total agricultural production values.

3.16.5 ENVIRONMENTAL CONSEQUENCES AND MITIGATION MEASURES

EFFECTS ANALYSIS

Effects related to socioeconomics resulting from implementation of the project were not previously described in the 2001 FEIS. The effects conclusions and mitigation measures are summarized in Table 3.16-21.

No-Action Alternative

EFFECT SOCIO-1 **Temporary Increase in Employment and Personal Income Resulting from Construction-Related Activities.** *The No-Action Alternative would not result in construction-related jobs and personal income. No effect would occur.*

Because construction of the water storage facilities would not occur, the No-Action Alternative would not result in construction-related jobs and personal income. **No effect** would occur.

EFFECT SOCIO-2 **Temporary Increase in Population and Housing Demand Resulting from Construction of Water Storage Facilities.** *Under the No-Action Alternative, no construction workers would be needed and the population and housing conditions and labor force characteristics are expected to continue following current trends. No effect would occur.*

Under the No-Action Alternative, construction of the water storage facilities would not occur. Therefore, no construction workers would be needed and the population and housing conditions and labor force characteristics are expected to continue following current trends described in Section 3.16.2, "Affected Environment." **No effect** would occur.

EFFECT SOCIO-3 **Temporary Increase in State and Local Sales Tax Revenues from Construction-Related Personal Income and Purchases.** *Under the No-Action Alternative, there would be no construction-related increase in personal income and purchases that would increase State and local sales tax revenues. No effect would occur.*

Under the No-Action Alternative, construction of the water storage facilities would not occur and there would be no construction-related increase in personal income and purchases that would increase state and local sales tax revenues. **No effect** would occur.

EFFECT SOCIO-4 **Permanent Effects on Employment and Personal Income Resulting from Operation and Maintenance of Water Storage Facilities.** *The No-Action Alternative would not result in project-related jobs and personal income or the loss of agricultural-related jobs and personal income. No effect would occur.*

Implementation of the No-Action Alternative would generally result in the continuation of existing land uses; agricultural intensity on the islands would increase as areas that are currently fallow are converted to agricultural use. There would be no project-related uses that would increase employment and personal income.

Because all four project islands would remain in agricultural uses and because agricultural intensity on the islands would increase, operation of the No-Action Alternative would result in the generation of agricultural-related jobs and personal income. In 2010, agricultural uses on the project islands generated 192 direct and indirect jobs and of $5.2 million in personal income. Implementing the No-Action Alternative would increase the amount of land in agricultural production on the project islands from approximately 16,741 acres (including pasture) to approximately 18,720 acres (ICF 2001: 3I-24). As discussed in Section 3.2, "Agricultural Resources," it is unlikely that increases in agricultural-related jobs and personal income under the No-Action Alternative would be permanent over the long term. Therefore, under the No-Action Alternative, no loss of agricultural-related jobs and personal income would occur; thus, there would be **no effect**.

EFFECT SOCIO-5 Permanent Increase in Population and Housing Demand Resulting from Operation and Maintenance of Water Storage Facilities. *The No-Action Alternative would not permanently increase population and housing demand and the population and housing conditions and labor force characteristics are expected to continue following current trends. No effect would occur.*

Implementation of the No-Action Alternative would generally result in the continuation of existing land uses. Therefore, there would be no project-related uses that would permanently increase population and housing demand and the population and housing conditions and labor force characteristics are expected to continue following current trends described in Section 3.16.2, "Affected Environment." **No effect** would occur.

EFFECT SOCIO-6 Permanent Increases in Spending, Income, and Employment Generated by Recreational Activities on the Project Islands. *Under the No-Action Alternative, an intensive for-fee hunting program would be operated on the project islands, which would generate spending, income, and employment in Contra Costa and San Joaquin Counties. This effect is beneficial and less than significant.*

Under the No-Action Alternative, an intensive for-fee hunting program would be operated on the project islands. This program would attract recreationist and nonlocal visitors from outside of Contra Costa and San Joaquin Counties. An estimated $742,100 (in 2010 dollars) would be generated by spending of recreationists and nonlocal visitors in eating and drinking places, hotels and other lodging, and retail establishments within Contra Costa and San Joaquin Counties. In turn, this spending would generate 23 new full-time jobs, which would generate an estimated $410,000 (in 2010 dollars) in personal income in Contra Costa and San Joaquin Counties for those new employees. This effect is **beneficial** and **less than significant**.

EFFECT SOCIO-7 *Permanent Effects on Agricultural Economics from Idling of Crops on the Project Islands. Under the No-Action Alternative, no loss of crop acreage, crop production value, or value added would occur that could affect agricultural economics in Contra Costa and San Joaquin Counties and the region. No effect would occur.*

Under the No-Action Alternative, more intensive agricultural operations would be implemented on the four project islands. Changes in crop acreage can be used to describe the associated changes in economic values. In 2010, the project islands included a total of 16,741 acres of crops, which resulted in a crop production value of $18.8 million and $9.0 million in value added. Implementing the No-Action Alternative would increase the amount of land in agricultural production on the project islands from approximately 16,741 acres (including pasture) under 2010 conditions to approximately 18,720 acres (ICF 2001: 3I-24). This increase in crop acreage would result in an increase crop production value and value added. However, given new information and recent conditions in the Delta (e.g., continued subsidence, increased levee vulnerability), it is reasonable to conclude that if agriculture were to be intensified under the No-Action Alternative, it likely would not continue on a long-term basis.

Although irrigation and drainage systems would be improved on the project islands to provide for long-term agricultural production, implementation of the No-Action Alternative would not provide additional flood control benefit or create additional levee stability. Additionally, lands would likely continue to subside, especially in the central and western Delta where the project islands are located and as such would continue to threaten the long-term sustainability of agriculture on the project islands. (See Section 3.2, “Agricultural Resources,” for further discussion.)

Given these considerations, it is unlikely that increases in crop acreage, crop production value, and value added on the project islands under the No-Action Alternative would benefit agriculture-related industries for any long-term period. However, under the No-Action Alternative, no loss of crop acreage, crop production value, or value added would occur; thus, there would be **no effect** on agricultural economics in Contra Costa and San Joaquin Counties and the region.

EFFECT SOCIO-8	Increased Profits for Landowners of the Project Islands Resulting from the Sale of Project Water. *Under the No-Project Alternative, there would be no sale of project water that would increase profits for landowners of the project islands. No effect would occur.*

Implementation of the No-Action Alternative would generally result in the continuation of existing land uses. Therefore, there would be no sale of project water that would increase profits for landowners of the project islands. **No effect** would occur.

EFFECT SOCIO-9	Permanent Increase in State and Local Sales Tax Revenues from Personal Income and Purchases. *Under the No-Action Alternative, there would be no construction-related increase in personal income and purchases that would increase state and local sales tax revenues. No effect would occur.*

Implementation of the No-Action Alternative would generally result in the continuation of existing land uses. Therefore, there would be no project-related increase in personal income and purchases that would increase state and local sales tax revenues. **No effect** would occur.

EFFECT SOCIO-10	Increases in Property Taxes and Values Associated with Profits from the Sale of Project Water. *Under the No-Action Alternative, there would be no increases in property tax revenues to Contra Costa and San Joaquin Counties. No effect would occur.*

Implementation of the No-Action Alternative would generally result in the continuation of existing land uses. Property owners would continue to pay property taxes in accordance with existing valuations and there would be no increases in property tax revenues to Contra Costa and San Joaquin Counties. **No effect** would occur.

EFFECT SOCIO-11	Economic Effects in the Places of Use Resulting from Improved Water Availability and Reliability. *Under the No-Action Alternative, no project water would be provided to the places of use. No effect would occur.*

Implementation of the No-Action Alternative would generally result in the continuation of existing land uses. Therefore, no project water would be provided to south-of-Delta groundwater banks or water districts for water supply. **No effect** would occur.

Alternative 1 and Alternative 2 (Proposed Action)

The effects analysis and mitigation measures for Alternatives 1 and 2 are the same; therefore, they are described together under this heading.

EFFECT SOCIO-1 **Temporary and Short-Term Increases in Employment and Personal Income Resulting from Construction-Related Activities.** *Implementation of Alternatives 1 and 2 would result in temporary and short-term increases in employment and personal income in Contra Costa and San Joaquin Counties from construction-related activities. Construction of proposed water storage facilities would generate an estimated 344 direct, indirect, and induced jobs and an estimated $21.5 million in personal income. These new jobs are expected to provide temporary, short-term employment opportunities to many unemployed workers and spending related to construction would result in substantial local economic activity in the region. Because construction of water storage facilities would result in a temporary and short-term increase in construction-related employment and personal income, the economic effects in Contra Costa and San Joaquin Counties resulting from project construction are beneficial and less than significant.*

Implementation of Alternatives 1 and 2 would result in temporary and short-term increases in employment and personal income in Contra Costa and San Joaquin Counties from construction-related activities. Construction of the water storage facilities would generate personal income through payments to employees, management earnings, contractor payments, and subsequent household and business spending in the regional economy. The increased construction expenditures are expected to result in a temporary and short-term increase in regional employment. Table 3.16-16 shows the direct and total (direct, indirect, and induced) number of full-time job equivalents and personal income that would be generated during construction of Alternatives 1 and 2.

Table 3.16-16
Employment and Personal Income Generated by Construction-Related Activities under Alternatives 1 and 2 (Proposed Action)

Economic Effect	Water Storage Facilities[1]
Employment (FTE)	
Direct	206
Total Jobs[2]	344
Personal Income (million $ per year)	
Total[3]	21.5

Notes: FTE = full-time equivalent

1 Construction of water storage facilities under Alternatives 1 and 2 is estimated to occur over 1.5 years.
2 Total employment includes direct, indirect, and induced employees per year of construction.
3 Personal income is presented in 2010 dollars and includes income generated by direct, indirect, and induced income per year of construction.

Source: ICF 2001:Table 3K-5; adapted by AECOM in 2014

As shown in Table 3.16-16, approximately 344 new workers would be needed over the 1.5-year construction period to support the construction activities related to water storage facilities. Construction of the water storage facilities would require approximately 206 construction workers and would create an additional 138 indirect and induced jobs. Overall, these jobs represent a relatively small increase (0.04%) in the total labor force in Contra Costa and San Joaquin Counties (approximately 824,100 employees) per year, but would represent an increase in employment for many rural communities surrounding the project islands. The employment opportunities created by Alternatives 1 and 2 represent a substantial contribution in counties that have high unemployment rates. Within Contra Costa and San Joaquin Counties, the 2010 unemployment rates exceeded 11% and 16%, respectively (Table 3.16-5). These new jobs are expected to provide temporary employment opportunities to many unemployed workers.

Personal income would be generated by wages paid directly to construction workers and workers in construction-related and service-oriented businesses. In total it is estimated that $21.5 million in personal income would be generated during the proposed 1.5-year water storage facility construction period. Spending related to construction would result in substantial local economic activity in the region.

Because construction of water storage facilities would result in a temporary and short-term increase in construction-related employment and personal income, the economic effects in Contra Costa and San Joaquin Counties resulting from project construction are **beneficial** and **less than significant**.

Mitigation Measure: No mitigation is required.

EFFECT SOCIO-2 **Temporary and Short-Term Increases in Population and Housing Demand Resulting from Construction of Water Storage Facilities.** *Implementation of Alternatives 1 and 2 would result in temporary and short-term increases in population and housing demand in Contra Costa and San Joaquin Counties as a result of construction of water storage facilities. Because workers serving the project could be expected to come from nearby communities and cities in Contra Costa and San Joaquin Counties, neither substantial population growth nor an increase in housing demand in the region is anticipated as a result of these jobs. Therefore, effects associated with temporary and short-term increases in population and housing demand from construction of water storage facilities are less than significant.*

Implementation of Alternatives 1 and 2 would result in temporary and short-term increases in population and housing demand in Contra Costa and San Joaquin Counties as a result of construction of water storage facilities. As shown on Table 3.16-16, approximately 206 direct construction-related jobs and 138 indirect and induced jobs are expected to be created from construction support industries and increased household spending.

As shown in Table 3.16-7, it is estimated that 47,400 residents in Contra Costa County and 4,600 residents in San Joaquin County were employed in the construction industry in 2010. These existing residents in both counties who are employed in the construction industry would likely be sufficient to meet the demand for construction workers that would be generated by the project. Between 2010 and 2020, the number of construction jobs is anticipated to increase by 28.9% in both counties (Table 3.16-7). Furthermore, if some nonlocal construction workers were employed for the project, the temporary and short-term nature of the work supports the conclusion that these workers would not typically change residences when assigned to a new construction site. Therefore, it is likely that an adequate number of construction workers for project construction could be found within the local area.

In total, construction of the water storage facilities would generate a total of approximately 344 direct, indirect, and induced jobs (Table 3.16-16). Overall, the number of direct, indirect, and induced jobs would represent a relatively small increase (less than 1%) in the total labor force in the two counties (approximately 824,100 employees). Even if a relatively small number of workers were to come from outside the local area, sufficient housing capacity (e.g., rental vacancies) exists in the area.

Because workers serving the project could be expected to come from nearby communities and cities in Contra Costa and San Joaquin Counties, neither substantial population growth nor an increase in housing demand in the region is anticipated as a result of these jobs. Therefore, effects associated with temporary and short-term increases in population and housing demand from construction-related activities are **less-than-significant**.

Mitigation Measure: No mitigation is required.

EFFECT SOCIO-3 **Temporary and Short-Term Increase in State and Local Sales Tax Revenues from Construction-Related Personal Income and Purchases.** *Implementation of Alternatives 1 and 2 would result in a substantial increase in total personal income (direct, indirect, and induced) during the construction period. This additional income, in combination with the construction-related purchases in Contra Costa and San Joaquin Counties, would result in a substantial increase in state and local sales tax revenues from increased consumer spending in nearby cities and both counties. Therefore, effects associated with temporary and short-term increase in state and local sales tax revenues from construction-related personal income and purchases are beneficial and less than significant.*

Implementation of Alternatives 1 and 2 would result in a substantial increase in total personal income (direct, indirect, and induced) during the construction period. This additional income, in combination with the construction-related purchases in Contra Costa and San Joaquin Counties, would result in a substantial increase in state and local sales tax revenues from increased consumer spending in nearby communities and cities and both counties.

A large amount of construction material would be required for construction of water storage facilities. These purchases may include raw or refined materials, and/or equipment required for the construction process, fuel for vehicles and equipment, and other incidental materials and supplies. Of this material, it is expected that most would be procured from businesses within Contra Costa and San Joaquin Counties. Indirect expenditures would consist of spending on goods and services by industries that produce the items purchased as part of the project and induced expenditures would consist of spending by the households of workers involved either directly or indirectly in the construction process. As a result, local businesses would experience temporary and short-term increases in sales tax revenues and profits over the construction period.

As shown in Table 3.16-16, it is estimated that a total of $21.5 million in personal income would be generated during the proposed 1.5-year water storage facility construction period. According to an economic assessment of water transfers prepared for the California Department of Water Resources, households spend about 15.5% of labor income on retail sales (TCW Economics 2009). Thus, retail purchases associated with construction of water storage facilities would increase by an estimated total of $3.3 million.

In 2010, the statewide sales tax rate was 7.5%, of which 1.0% of this total was returned directly to Contra Costa and San Joaquin Counties. Applying the 1.0% local sales tax rate to taxable sales would produce an estimated total sales tax revenue of $330,000 from construction of water storage facilities. Substantial increases in local sales tax revenue could then be used to establish new programs and initiatives or bolster existing ones through additional funding. New and improved programs and initiatives could provide benefits to local residents. Therefore, effects associated with temporary and short-term increases in state and local sales tax revenues from construction-related personal income and purchases are **beneficial** and **less than significant**.

Mitigation Measure: No mitigation is required.

EFFECT SOCIO-4 **Permanent Effects on Employment and Personal Income Resulting from Operation and Maintenance of Water Storage Facilities.** *Alternatives 1 and 2 would generate an estimated 222 permanent jobs and a projected $12.1 million in annual, permanent income from operation and maintenance of water storage facilities. This gain in income would partially offset the loss of an estimated 99 jobs and $2.7 million in personal income currently generated by agricultural operations. Implementation of Alternatives 1 and 2 would thus result in the projected net gain of an estimated 123 jobs and approximately $9.4 million in annual income in San Joaquin and Contra Costa Counties. The increase in employment and personal income from operation and maintenance of water storage facilities is a beneficial and less-than-significant effect. However, the loss of jobs and personal income to farmworkers and other workers in agriculture-related industries is a significant effect.*

Implementation of Alternatives 1 and 2 would permanently increase employment and personal income in Contra Costa and San Joaquin Counties from operation and maintenance of water storage facilities. However, conversion of Bacon Island and Webb Tract to water storage facilities would directly and indirectly result in the loss of agricultural-related jobs and personal income.

Table 3.16-17 shows the direct and total (direct, indirect, and induced) number of full-time equivalent employees and personal income that would be generated from operation and maintenance activities under Alternatives 1 and 2. Operation and maintenance of the water storage facilities would generate an estimated total of 222 direct, indirect, and induced jobs. Approximately 75 direct and an additional 147 indirect and induced jobs would be generated by operation and maintenance of the water storage facilities. Overall, these jobs represent a relatively small increase (0.03%) in the total labor force in Contra Costa and San Joaquin Counties (approximately 824,100 employees), but would represent an increase in employment for many rural communities surrounding the project islands.

Table 3.16-17
Employment and Personal Income Generated by Operation and Maintenance Activities under Alternatives 1 and 2 (Proposed Action)

Economic Effect	Water Storage Facilities[1]
Employment (FTE)	
Direct	75
Total Jobs[2]	222
Total Personal Income (million $ per year)[3]	12.1

Notes: FTE = full-time equivalent

1 Agricultural operations associated with the management of the Habitat Islands would be relatively small and is included in employment projections for operation of water storage facilities.

2 Total employment includes direct, indirect, and induced employees.

3 Personal income is presented in 2010 dollars and includes income generated by direct, indirect, and induced income. Personal income related to operation and maintenance of water storage facilities was not differentiated in the 2001 FEIS; therefore, the personal income associated with water storage alone has been prorated.

Source: ICF 2001:Table 3K-5; adapted by AECOM in 2014

Personal income would be generated over the buildout period, beginning with the operation of the water storage facilities and reaching a permanent, maximum level at buildout of the recreation facilities. As shown in Table 3.16-17, it is estimated that $12.1 million in personal income per year would be generated from operations and maintenance of water storage facilities. This increase in personal income represents an approximately 15.5% increase in all annual personal income in Contra Costa and San Joaquin Counties (approximately $78.5 million) (Table 3.16-8).

Implementation of Alternatives 1 and 2 would remove existing agricultural operations on Bacon Island and Webb Tract, resulting in the loss of an estimated 99 direct and indirect jobs and result in a loss of $2.7 million in personal income. Employment groups sustaining the greatest effects would include on-site farmworkers and losses of jobs and income for businesses that support the agricultural industry, including farm and equipment-supply stores and those that earn their income by selling, transporting, storing, marketing, and processing agricultural products, would occur. Overall, these jobs represent a relatively small decrease in the total labor force (0.02%) and total personal income (3%) in Contra Costa and San Joaquin Counties. However, the economic effects of crop idling on farmworkers tend to be concentrated within small subgroups of the regional economy, such as those within project islands. In this instance, if the jobs of these subgroups on the project islands were lost, these job losses could be a substantial adverse effect for these people (U.S. Bureau of Reclamation, California Department of Water Resources, U.S. Fish and Wildlife Service, NOAA Fisheries, and California Department of Fish and Game 2003).

Alternatives 1 and 2 would generate approximately 222 permanent jobs and a projected $12.1 million in annual, permanent income from operation and maintenance of water storage facilities. This gain in income would partially offset the loss of an estimated 99 jobs and $2.7 million in personal income currently generated by agricultural operations. Implementation of Alternatives 1 and 2 would thus result in the projected net gain of an estimated 123 jobs and approximately $9.4 million in personal income in San Joaquin and Contra Costa Counties. The increase in employment and personal income from operation and maintenance of water storage facilities is a **beneficial** and **less-than-significant** effect.

While a net increase in employment would result from operation and maintenance of water storage facilities, it cannot be assumed that these jobs would be filled by displaced agricultural workers because the skills required may not be comparable. Therefore, the loss of jobs and personal income to farmworkers and other workers in agriculture-related industries is a **significant** effect.

Mitigation Measure: No mitigation is required.

While a net increase in employment would result from operation and maintenance of water storage facilities, it would not reduce significant effects related to the loss of jobs and personal income to farmworkers and other workers in agriculture-related industries to a less-than-significant level. No feasible mitigation is available; therefore, this effect is **significant and unavoidable**.

EFFECT SOCIO-5 Permanent Increase in Population and Housing Demand Resulting from Operation and Maintenance of Water Storage Facilities. *Implementation of Alternatives 1 and 2 would permanently increase population and housing demand in Contra Costa and San Joaquin Counties as a result of operation and maintenance of water storage facilities. Because the operational and maintenance workers serving the project could be expected to come from nearby communities and cities in Contra Costa and San Joaquin Counties, neither substantial population growth nor an increase in housing demand in the region is anticipated as a result of these jobs. Therefore, effects associated with increases in population and housing demand from operation and maintenance of the water storage facilities are less than significant.*

Implementation of Alternatives 1 and 2 would permanently increase population and housing demand in Contra Costa and San Joaquin Counties as a result of operation and maintenance of water storage facilities. As shown of Table 3.16-17, operation and maintenance of the water storage facilities would generate a total of approximately 222 direct, indirect, and induced jobs within Contra Costa and San Joaquin Counties. Overall, the number of direct, indirect, and induced jobs would represent a relatively small increase (0.03%) in the total labor force in Contra Costa and San Joaquin Counties (approximately 824,100 employees). Between 2010 and 2020, Contra Costa and San Joaquin Counties are expected to have a 15.8% and 20.6%, respectively, increase in nonfarm jobs. Given the large workforce in Contra Costa and San Joaquin Counties, is anticipated that most of these new jobs would be filled from the existing workforce in the two counties. Even if a relatively small number of workers were to come from outside the local area, sufficient housing capacity (e.g., rental housing, motel, and apartment vacancies) exists in the area.

Because the operational and maintenance workers serving the project could be expected to come from nearby communities and cities in Contra Costa and San Joaquin Counties, neither substantial population growth nor an increase in housing demand in the region is anticipated as a result of these jobs. Therefore, effects associated with increases in population and housing demand from operation and maintenance of the water storage facilities are **less than significant**.

Mitigation Measure: No mitigation is required.

EFFECT SOCIO-6	Permanent Increases in Spending, Income, and Employment Generated by Recreational Activities on the Project Islands. *Implementation of Alternatives 1 and 2 would not include construction of recreational facilities; therefore, no effect would occur.*

Implementation of Alternatives 1 and 2 would not include construction of new project-related recreational facilities; therefore, **no effect** would occur.

Mitigation Measure: No mitigation is required.

EFFECT SOCIO-7	Permanent Effects on Agricultural Economics from Idling of Crops on the Project Islands. *In total, implementation of Alternatives 1 and 2 would result in in a loss of an estimated 14,805 acres of crops, $17.4 million in production value, and $8.0 million in value added. Therefore, the economic effects from idling of crops on the project islands are significant.*

Implementation of Alternatives 1 and 2 would convert agricultural land uses on Bacon Island and Webb Tract to water storage facilities and would change cropping patterns on Bouldin Island and Holland Tract for the life of the project. For the purposes of this analysis, the changes in crop acreage on the project islands were used to estimate the associated changes in economic values.

As shown on Table 3.16-10, a total of approximately 4,860 acres of wheat, corn, alfalfa, oats, and sunflowers were planted on Bacon Island and approximately 4,064 acres of corn were planted on Webb Tract in 2010. Together, the conversion of Bacon Island and Webb Tract to water storage facilities would result in a loss of approximately 8,924 acres of crops, $6.5 million in production value, and $4.3 million in value added. The total production value would be somewhat greater since production estimates for oats and sunflowers were not included in the 2010 crop report for San Joaquin County.

Implementation of Alternatives 1 and 2 would result in changes to cropping patterns on Bouldin Island and Holland Tract as part of the proposed CMP. As shown on Table 3.16-10, a total of approximately 4,933 acres of corn, rice, and tomatoes were planted on Bouldin Island and approximately 2,884 acres of pasture were planted on Holland Tract in 2010. These crops had a production value of $5.5 million and a value added of $4.4 million.

Estimated yield, production levels, and total production value for the crops grown on the Habitat Islands are shown in Table 3.16-18. Under Alternatives 1 and 2, an estimated 4,691 acres would be planted in corn, wheat, barley, and pasture to enhance wildlife habitat. Of this total, an estimated 1,196 acres would be harvested for sale resulting in an estimated production value of $1.3 million and a value added of approximately $917,700. Approximately 2,755 acres would be planted as mixed agriculture/seasonal wetland but would not be harvested.

The sale of grain crops planted for wildlife habitat would partially offset the loss of agricultural production value and value added on Bouldin Island and Holland Tract; however, overall crop acreage, crop production value, and value added would be reduced. In total, conversion of agricultural land uses on Bacon Island and Webb Tract to water storage facilities and changes in cropping patterns on Bouldin Island and Holland Tract would result in in a loss of approximately 14,805 acres of crops, $10.7 million in production value, and $7.8 million in value added.

The effect of losses in agricultural production in Contra Costa and San Joaquin Counties would be attenuated by some of the project features and actions, which are discussed below.

- **Restoring Agricultural Production on Project Islands.** As discussed in Chapter 2 “Project Description and Alternatives,” agricultural production would be eliminated from project’s reservoir islands. However, the conversion of these agricultural lands is not considered irreversible. Once the project ceases operation, the reservoir islands would be made available for agricultural production. Use of the project islands for water storage activities is not expected to have an adverse effect on the productive capabilities of island soils.

Table 3.16-18
Estimated Crop Yields and Total Crop Values on the Habitat Islands under Alternatives 1 and 2 (Proposed Action) (in 2010 Dollars)

	Bouldin Island					Holland Tract[1]					Total			
Crop	Acres Planted	Acres Harvested[2]	Yield (tons per acre)	Total Yield (tons)	Total Crop Value	Acres Planted	Acres Harvested[2]	Yield (tons per acre)	Total Yield (tons)	Total Crop Value	Acres Planted	Acres Harvested[2]	Total Yield (tons)	Total Crop Value
Corn	1,222	819	5.28	4,324	$756,756	716	480	4.09	1,963	$341,597	1,938	1,299	6,287	$1,098,353
Wheat[3]	487	244	3.44	839	$140,173	353	177	2.19	388	$52,330	840	421	1,227	$192,503
Barley	26	13	N/A	N/A	$10,647	38	19	N/A	N/A	$15,561	64	32	N/A	$26,208
Pasture	132	119	N/A	N/A	$19,635	72	65	N/A	N/A	$11,375	204	184	N/A	$31,010
Mixed Agriculture/ Seasonal Wetlands[4]	1,014	N/A	N/A	N/A	N/A	631	N/A	N/A	N/A	N/A	1,645	N/A	N/A	N/A
Total	**2,881**	**1,195**	**--**	**5,163**	**$927,211**	**1,810**	**741**	**--**	**2,351**	**$420,863**	**4,691**	**1,936**	**7,514**	**$1,348,074**

Notes: N/A = not applicable. Represents acreages of crops planted for wildlife habitat. No crops would be planted on Bacon Island and Webb Tract. These acreages are based on the draft CMP and may be revised in the final CMP. Inconsistencies in acreages are the result of rounding and conversion of 1995 EIR/EIS and 2000 REIR/REIS data to GIS.

1 Excludes crops grown on the approximately 1,120 acres on nonproject Holland Tract lands.

2 Represents acreages of crops that would be harvested and sold.

3 Includes spring and winter wheat.

4 Acreage devoted to mixed agricultural/seasonal wetland would not be harvested.

Sources: Planted acreage projections: 1995 EIR/EIS Appendix G3, "Habitat Management Plan for the Delta Wetlands Habitat Islands." Average yield projections: Contra Costa County 2011; San Joaquin County 2011; TCW Economics 2009; RMecon 2002; ICF 2010:4.8-41; adapted by AECOM in 2013

- **Enhancing Sustainability of In-Delta Agriculture.** The project's effect on agricultural land would be further offset by the project's environmental commitment to place conservation easements on habitat islands (see Chapter 2, "Project Description and Alternatives") and enhancing the stability of levees on project islands. Enhancing the stability of the project's levees would help benefit agriculture by reducing the threat of levee failure on the habitat islands and other islands within the Delta that also support agriculture.

However, despite these project-related benefits which would somewhat offset the adverse effects of agricultural land conversion, permanent effects on agricultural economics from idling of crops on the project islands is a **significant** socioeconomics effect.

Mitigation Measure: No mitigation is required.

Implementation of project features and actions described above, including restoring agricultural production on project islands used for water storage purposes at the end of the project's 50-year lifespan and contributing to the sustainability of in-Delta agriculture through enhancement of levee stability on the project islands, would ensure that permanent conversion of agricultural land and production could be avoided; however, it would not reduce the long-term loss of crop acreage, crop production values, and value added during the 50-year life of the project. Therefore, the economic effects from idling of crops on the project islands are **significant and unavoidable**.

EFFECT SOCIO-8 **Permanent Increase in State and Local Sales Tax Revenues from Personal Income and Purchases.** *Implementation of Alternatives 1 and 2 would result in a substantial increase in total personal income (direct, indirect, and induced) that would result in a substantial increase in state and local sales tax revenues from increased consumer spending in nearby cities and both counties. Therefore, effects associated with permanent increases in state and local sales tax revenues from personal income and purchases are beneficial and less than significant.*

Implementation of Alternatives 1 and 2 would result in a substantial increase in total personal income (direct, indirect, and induced) from operation and maintenance of water storage facilities that would result in a substantial increase in state and local sales tax revenues from increased consumer spending in nearby cities and both counties. As shown in Table 3.16-17, it is estimated that $12.1 million in personal income per year would be generated from operations and maintenance of water storage facilities. Conversely, conversion of the four project islands to water storage facilities would result in the estimated loss of $2.7 million in personal income.

In total, implementation of Alternatives 1 and 2 would result in an estimated $12.1 million increase in personal income. According to an economic assessment of water transfers prepared for the California Department of Water Resources, households spend about 15.5% of labor income on retail sales (TCW Economics 2009). Thus, retail purchases associated with operation and maintenance of water storage facilities would increase by about $1.9 million in Contra Costa and San Joaquin Counties.

In 2010, the statewide sales tax rate was 7.5%, of which 1.0% of this total was returned directly to Contra Costa and San Joaquin Counties. Applying the 1.0% local sales tax rate to taxable sales produces an estimated sales tax increase of $190,000 per year.

Substantial increases in local sales tax revenue could then be used to establish new programs and initiatives or bolster existing ones through additional funding. New and improved programs and initiatives could provide benefits to local residents. Therefore, effects associated with permanent increases in State and local sales tax revenues from increases in personal income and purchases are **beneficial** and **less than significant**.

Mitigation Measure: No mitigation is required.

EFFECT SOCIO-9 **Increases in Property Taxes and Values Associated with Profits from the Sale of Project Water**. *Water-transfer payments presumably would increase average economic returns, thereby increasing property values. Subsequently, reappraisals of farm properties for property tax purposes would occur resulting in increases property tax revenues. Therefore, effects associated with increases in property taxes and values from the sale of project water are beneficial and less-than-significant.*

Local governments are dependent on property tax revenues for financing of local services and education. Water transfers represent a potential source of profits since, theoretically, expected profits from the sale of water would exceed the profits expected from farming the land (TCW Economics 2009:5). The income provided by water-transfer payments presumably would increase average economic returns, thereby increasing property values. Reappraisals of farm properties for property tax purposes would likely occur resulting in increases property tax. Subsequently, property tax revenues to Contra Costa and San Joaquin Counties would also increase. Therefore, effects associated with increases in property taxes and values from the sale of project water are **beneficial** and **less than significant**.

Mitigation Measure: No mitigation is required.

EFFECT SOCIO-10 **Economic Effects in the Places of Use Resulting from Improved Water Availability and Reliability.** *Implementation of Alternatives 1 and 2 would improve water availability and reliability for the south-of-Delta water users identified in the places of use. Therefore, this water supply would create broad economic benefits for regions whose growth is supported by increased deliveries. This effect is beneficial and less than significant.*

As discussed above, the specific places of use for project water consist of Semitropic, Metropolitan, Western, and Golden State. These places of use require additional sources of water to improve the reliability of their existing water supplies to meet current demand. Project water would be exported and stored in the Semitropic Groundwater Bank and/or the Antelope Valley Water Bank, from whence it could be purchased and used by Semitropic, Metropolitan, Western, or Golden State. Project water that is purchased and used by Semitropic, Metropolitan, and Western ultimately would benefit agriculture in those service areas by supplementing existing agricultural water supplies. Water purchased and used by Western and Metropolitan as well as Golden State would also increase the reliability of existing municipal and industrial deliveries for areas currently served.

Improved water availability and reliability expected to result from implementation of Alternatives 1 and 2 could potentially increase agricultural production by providing more consistent water supplies, especially in dry years, thereby increasing agricultural production and net income. Under this scenario, it would also be anticipated that employment directly and indirectly associated with agriculture would increase and result in increases in personal income.

Increased municipal and industrial deliveries in the places of use would remove a barrier to growth and would meet water supply demands associated with increased population growth anticipated by each urban water management plan. Subsequently, population growth would stimulate economic activity from increased demand for goods and services. (See Chapter 4, “Other Statutory Requirements,” for a discussion of growth-inducing effects.)

Because the project water would improve water availability and reliability for the Semitropic, Metropolitan, Western, and Golden State water users, this water supply would result in **beneficial** and **less-than-significant** effects for regions whose growth is supported by increased deliveries.

Mitigation Measure: No mitigation is required.

Alternative 3

EFFECT SOCIO-1	Temporary and Short-Term Increases in Employment and Personal Income Resulting from Construction-Related Activities. *Implementation of Alternative 3 would result in temporary and short-term increases in employment and personal income in Contra Costa and San Joaquin Counties from construction-related activities. Construction of proposed water storage facilities would generate an estimated total of 732 direct, indirect, and induced jobs and an estimated $45.8 million in personal income. These new jobs are expected to provide temporary employment opportunities to many unemployed workers and spending related to construction would result in substantial local economic activity in the region. Because construction of water storage facilities would result in a temporary and short-term increase in construction-related employment and personal income, the economic effects in Contra Costa and San Joaquin Counties resulting from project construction are beneficial and less than significant.*

Implementation of Alternative 3 would result in temporary and short-term increases in employment and personal income in Contra Costa and San Joaquin Counties from construction-related activities. Construction of the water storage facilities under Alternative 3 would generate substantially more jobs and personal income as compared to Alternatives 1 and 2. Table 3.16-19 shows the direct and total (direct, indirect, and induced) number of full-time job equivalents and personal income that would be generated during construction of Alternative 3.

As shown in Table 3.16-19, approximately 732 new workers would be needed over the 2.5-year construction period to support the construction activities related to water storage facilities. Construction of the water storage facilities would require approximately 440 construction workers and would create an additional 292 indirect and induced jobs.

Table 3.16-19
Employment and Personal Income Generated by Construction-Related Activities under Alternative 3

Economic Effect	Water Storage Facilities[1]
Employment (FTE)	
Direct	440
Total Jobs[2]	732
Personal Income (million $ per year)	
Total[3]	45.8

Notes: FTE = full-time equivalent

1 Construction of water storage facilities under Alternative 3 is estimated to occur over 2.5 years.
2 Total employment includes direct, indirect, and induced employees per year of construction.
3 Personal income is presented in 2010 dollars and includes income generated by direct, indirect, and induced income per year of construction.

Source: ICF 2001:Table 3K-5; adapted by AECOM in 2014

Overall, these jobs represent a relatively small increase (0.1%) in the total labor force in Contra Costa and San Joaquin Counties (approximately 824,100 employees) per year, but would represent an increase in employment for many rural communities surrounding the project islands. The employment opportunities created by Alternatives 1 and 2 represent a substantial contribution in counties that have high unemployment rates. Within Contra Costa and San Joaquin Counties, the 2010 unemployment rates exceeded 11% and 16%, respectively (Table 3.16-5). These new jobs are expected to provide temporary employment opportunities to many unemployed workers.

In total, it is estimated that $45.8 million in personal income would be generated during the proposed 2.5-year water storage facility construction period. Spending related to construction would result in substantial local economic activity in the region.

Because construction of water storage facilities would result in a temporary and short-term increase in construction-related employment and personal income, the economic effects in Contra Costa and San Joaquin Counties resulting from project construction are **beneficial** and **less than significant**.

Mitigation Measure: No mitigation is required.

EFFECT SOCIO-2 **Temporary and Short-Term Increase in Population and Housing Demand Resulting from Construction of Water Storage Facilities.** *Implementation of Alternative 3 would result in temporary and short-term increases in population and housing demand in Contra Costa and San Joaquin Counties as a result of construction of water storage facilities. Because workers serving the project could be expected to come from nearby communities and cities in Contra Costa and San Joaquin Counties, neither substantial population growth nor an increase in housing demand in the region is anticipated as a result of these jobs. Therefore, effects associated with temporary and short-term increases in population and housing demand from construction of water storage facilities are less than significant.*

Because Alternative 3 would generate substantially more jobs as compared to Alternatives 1 and 2, Alternative 3 would result in a greater increase in population as housing demand in Contra Costa and San Joaquin Counties as a result of construction of water storage facilities.

As shown on Table 3.16-19, approximately 440 direct construction-related jobs and 292 indirect and induced jobs are expected to be created from construction support industries and increased household spending. Overall, the number of direct, indirect, and induced jobs would represent a relatively small increase in the total labor force in the two counties. It is anticipated that existing residents in both counties who are employed in the construction industry would likely be sufficient to meet the demand for construction workers that would be generated by the project. Furthermore, if some nonlocal construction workers were employed for the project, the temporary and short-term nature of the work supports the conclusion that these workers would not typically change residences when assigned to a new construction site.

Because workers serving the project could be expected to come from nearby communities and cities in Contra Costa and San Joaquin Counties, neither substantial population growth nor an increase in housing demand in the region is anticipated as a result of these jobs. Therefore, effects associated with temporary and short-term increases in population and housing demand from construction of water storage facilities are less than significant.

Mitigation Measure: No mitigation is required.

EFFECT SOCIO-3 **Temporary and Short-Term Increase in State and Local Sales Tax Revenues from Construction-Related Personal Income and Purchases. I***mplementation of Alternative 3 would result in a substantial increase in total personal income (direct, indirect, and induced) during the construction period. This additional income, in combination with the construction-related purchases in Contra Costa and San Joaquin Counties, would result in a substantial increase in state and local sales tax revenues from increased consumer spending in nearby cities and both counties. Therefore, effects associated with the temporary and short-term increases in state and local sales tax revenues from construction-related personal income and purchases are beneficial and less than significant.*

Implementation of Alternative 3 would result in a greater increase in total personal income (direct, indirect, and induced) during the construction period as compared to Alternatives 1 and 2. This additional income, in combination with the construction-related purchases in Contra Costa and San Joaquin Counties, would result in a substantial increase in state and local sales tax revenues from increased consumer spending in nearby communities and cities and both counties.

As shown in Table 3.16-19, it is estimated that a total of $45.8 million in personal income would be generated during the proposed 2.5-year water storage facility construction period. Households spend about 15.5% of labor income on retail sales (TCW Economics 2009). Thus, retail purchases associated with construction of water storage facilities would increase by an estimated total of $7.1 million during the construction period.

In 2010, the statewide sales tax rate was 7.5%, of which 1.0% of this total was returned directly to Contra Costa and San Joaquin Counties. Applying the 1.0% local sales tax rate to taxable sales would produce an estimated total sales tax revenue of $710,000 from construction of water storage facilities during the construction period. Therefore, effects associated with temporary increase in state and local sales tax revenues from construction-related personal income and purchases are **beneficial** and **less than significant**.

Mitigation Measure: No mitigation is required.

EFFECT SOCIO-4 **Permanent Effects on Employment and Personal Income Resulting from Operation and Maintenance of Water Storage Facilities.** *Alternative 3 would generate an estimated 258 permanent jobs and a projected $14.1 million in annual, permanent income from operation and maintenance of water storage facilities. This gain in income would partially offset the loss of an estimated 192 jobs and $5.2 million in personal income currently generated by agricultural operations. Implementation of Alternative 3 would thus result in the projected net gain of 66 jobs and approximately $8.9 million in annual income in San Joaquin and Contra Costa Counties. The increase in employment and personal income from operation and maintenance of water storage facilities is a beneficial and less-than-significant effect. However, the loss of jobs and personal income to farmworkers and other workers in agriculture-related industries is a significant effect.*

Implementation of Alternative 3 would permanently increase employment and personal income in Contra Costa and San Joaquin Counties from operation and maintenance of water storage facilities. However, conversion of the four project islands to water storage facilities would directly and indirectly result in the loss of agricultural-related jobs and personal income.

Operation and maintenance of the water storage facilities under Alternative 3 would generate substantially more jobs and personal income as compared to Alternatives 1 and 2. Because the four project islands would be converted to water storage facilities, a substantially greater loss of jobs and personal income to farmworkers and other workers in agriculture-related industries would occur under Alternative 3 as compared to Alternatives 1 and 2.

Table 3.16-20 shows the direct and total (direct, indirect, and induced) number of full-time equivalent employees and personal income that would be generated from operation and maintenance activities under Alternative 3. Operation and maintenance of the water storage facilities would generate 85 direct and an additional 173 indirect and induced jobs for a total of 258 direct, indirect, and induced jobs. Overall, these jobs represent a relatively small increase (0.05%) in the total labor force in Contra Costa and San Joaquin Counties (approximately 824,100 employees), but would represent an increase in employment for many rural communities surrounding the project islands.

As shown in Table 3.16-20, it is estimated that $14.1 million in personal income per year would be generated from operations and maintenance of water storage facilities. This increase in personal income represents an approximately 18% increase in all annual personal income in Contra Costa and San Joaquin Counties (approximately $78.5 million) (Table 3.16-8).

Table 3.16-20
Employment and Personal Income Generated by Operation and Maintenance Activities under Alternative 3

Economic Effect	Water Storage Facilities
Employment (FTE)	
Direct	85
Total Jobs[1]	258
Total Personal Income (million $ per year)[2]	14.1

Notes: FTE = full-time equivalent

[1] Total employment includes direct, indirect, and induced employees.

[2] Personal income from operation and maintenance activities is presented in 2010 dollars and includes income generated by direct, indirect, and induced income and has been prorated.

Source: ICF 2001:Table 3K-5; adapted by AECOM in 2014

Implementation of Alternative 3 would convert the four project islands to water storage facilities, resulting in the loss of an estimated 192 direct and indirect jobs and result in a loss of approximately $5.2 million in personal income. Employment groups sustaining the greatest effects would include on-site farmworkers and losses of jobs and income for businesses that support the agricultural industry, including farm and equipment-supply stores and those that earn their income by selling, transporting, storing, marketing, and processing agricultural products, would occur. Overall, these jobs represent a relatively small decrease in the total labor force (0.08%) and total personal income (7%) in Contra Costa and San Joaquin Counties. However, the economic effects of crop idling on farmworkers tend to be concentrated within small subgroups of the regional economy, such as those within project islands. In this instance, if the jobs associated with these subgroups on the project islands were lost, these job losses could be a substantial adverse effect for these people (U.S. Bureau of Reclamation, California Department of Water Resources, U.S. Fish and Wildlife Service, NOAA Fisheries, and California Department of Fish and Game 2003).

Alternative 3 would generate an estimated 258 permanent jobs and a projected $14.1 million in annual, permanent income from operation and maintenance of water storage facilities. This gain in income would partially offset the loss of an estimated 192 jobs and $5.2 million in personal income currently generated by agricultural operations. Implementation of Alternative 3 would thus result in the projected net gain of 66 jobs and approximately $8.9 million in personal income in San Joaquin and Contra Costa Counties. The increase in employment and personal income from operation and maintenance of water storage facilities is a **beneficial and less-than-significant** effect.

While a net increase in employment would result from operation and maintenance of water storage facilities, it cannot be assumed that these jobs would be filled by displaced agricultural workers because the skills required may not comparable. Therefore, the loss of jobs and personal income to farmworkers and other workers in agriculture-related industries is a **significant** effect.

Mitigation Measure: No feasible mitigation is required.

While a net increase in employment would result from operation and maintenance of water storage facilities, it would not reduce significant effects related to the loss of jobs and personal income to farmworkers and other workers in agriculture-related industries to a less-than-significant level. No feasible mitigation is available; therefore, this effect is **significant and unavoidable**.

EFFECT SOCIO-5 **Permanent Increase in Population and Housing Demand Resulting from Operation and Maintenance of Water Storage Facilities.** *Implementation of Alternative 3 would permanently increase population and housing demand in Contra Costa and San Joaquin Counties as a result of operation and maintenance of water storage facilities. Because the operational and maintenance workers serving the project could be expected to come from nearby communities and cities in Contra Costa and San Joaquin Counties, neither substantial population growth nor an increase in housing demand in the region is anticipated as a result of these jobs. Therefore, effects associated with increases in population and housing demand from operation and maintenance of the water storage facilities are less than significant.*

Implementation of Alternative 3 would permanently increase population and housing demand in Contra Costa and San Joaquin Counties as a result of operation and maintenance of water storage facilities. Because Alternative 3 would generate substantially more jobs as compared to Alternatives 1 and 2, Alternative 3 would result in a greater increase in population as housing demand as a result of operation and maintenance of water storage facilities.

As shown of Table 3.16-20, operation and maintenance of the water storage facilities would generate a total of 258 direct, indirect, and induced jobs within Contra Costa and San Joaquin Counties. Overall, the number of direct, indirect, and induced jobs would represent a relatively small increase (0.04%) in the total labor force in Contra Costa and San Joaquin Counties (approximately 824,100 employees). Between 2010 and 2020, Contra Costa and San Joaquin Counties are expected to have a 15.8% and 20.6%, respectively, increase in nonfarm jobs. Given the large workforce in Contra Costa and San Joaquin Counties, is anticipated that most of these new jobs would be filled from the existing workforce in the two counties. Even if a relatively small number of workers were to come from outside the local area, sufficient housing capacity (e.g., rental housing, motel, and apartment vacancies) exists in the area.

Because the operational and maintenance workers serving the project could be expected to come from nearby communities and cities in Contra Costa and San Joaquin Counties, neither substantial population growth nor an increase in housing demand in the region is anticipated as a result of these jobs. Therefore, effects associated with increases in population and housing demand from operation and maintenance of the water storage facilities are **less than significant**.

Mitigation Measure: No mitigation is required.

EFFECT SOCIO-6 **Permanent Increases in Spending, Income, and Employment Generated by Recreational Activities on the Project Islands.** *Implementation of Alternative 3 would not include construction of recreational facilities; therefore, no effect would occur.*

Implementation of Alternative 3 would not include the construction of project-related recreational facilities; therefore, **no effect** would occur.

Mitigation Measure: No mitigation is required.

EFFECT SOCIO-7 **Permanent Effects on Agricultural Economics from Idling of Crops on the Project Islands.** *In total, implementation of Alternative 3 would result in in an estimated loss of 17,761 acres of crops, $18.8 million in production value, and $9.0 million in value added. Therefore, the economic effects from idling of crops on the project islands are significant.*

Implementation of Alternative 3 would convert agricultural land uses on all four project islands to water storage facilities, including the approximately 1,120 acres of pasture on Holland Tract excluded from the project under Alternatives 1 or 2, resulting in the loss of approximately 17,761 acres of crops. As stated above, changes in crop acreage can be used to describe the associated changes in economic values. Alternative 3 would convert a larger amount of crop acreage to water storage facilities; therefore, the overall loss of crop production value and value added would be greater than Alternatives 1 and 2.

Based on Contra Costa County's 2010 countywide crop data shown on Table 3.16-19, the conversion of an additional 1,120 acres of pasture would result in an additional loss of $1,140. In total, implementation of Alternative 3 would result in in a loss of approximately 17,761 acres of crops, $12.1 million in production value, and $9.0 million in value added. As stated above, the total production value would be somewhat greater since production estimates for oats and sunflowers were not included in the 2010 crop report for San Joaquin County.

The effect of losses in agricultural production in Contra Costa and San Joaquin Counties would be attenuated by some of the project features and actions, which are discussed below.

- **Restoring Agricultural Production on Project Islands.** As discussed in Chapter 2, "Project Description and Alternatives," agricultural production would be eliminated from project's reservoir islands. However, the conversion of these agricultural lands is not considered irreversible. Once the project ceases operation, the reservoir islands would be made available for agricultural production. Use of the project islands for water storage activities is not expected to have an adverse effect on the productive capabilities of island soils.

- **Enhancing Sustainability of In-Delta Agriculture.** The project's effect on agricultural land would be further offset by the project's environmental commitment to place conservation easements on habitat islands (see Chapter 2, "Project Description and Alternatives") and enhancing the stability of levees on project islands. Enhancing the stability of the project's levees would help benefit agriculture by reducing the threat of levee failure on the habitat islands and other islands within the Delta that also support agriculture.

However, despite these project-related benefits which would somewhat offset the adverse effects of agricultural land conversion, permanent effects on agricultural economics from idling of crops on the project islands is a **significant** socioeconomics effect.

Mitigation Measure: No feasible mitigation is required.

Implementation of project features and actions described above, including restoring agricultural production on project islands used for water storage purposes at the end of the project's 50-year lifespan and contributing to the sustainability of in-Delta agriculture through enhancement of levee stability on the project islands would ensure that permanent conversion of agricultural land and production could be avoided; however, it would not reduce the long-term loss of crop acreage, crop production values, and value added during the 50-year life of the project. Therefore, the economic effects from idling of crops on the project islands are **significant and unavoidable**.

EFFECT SOCIO-8 **Permanent Increase in State and Local Sales Tax Revenues from Personal Income and Purchases.** *Implementation of Alternative 3 would result in a substantial increase in total personal income (direct, indirect, and induced) that would result in a substantial increase in state and local sales tax revenues from increased consumer spending in nearby cities and both counties. Therefore, effects associated with permanent increases in state and local sales tax revenues from personal income and purchases are beneficial and less than significant.*

Implementation of Alternative 3 would result in a less total personal income (direct, indirect, and induced) as compared to Alternatives 1 and 2. Personal income (direct, indirect, and induced) from operation and maintenance of water storage facilities would result in a substantial increase in state and local sales tax revenues from increased consumer spending in nearby cities and both counties. As shown in Table 3.16-20, it is estimated that $14.1 million in personal income per year would be generated from operations and maintenance of water storage facilities. Conversely, conversion of the four project islands to water storage facilities would result in the loss of $5.2 million personal income.

In total, implementation of Alternative 3 would result in an estimated $8.9 million increase in personal income. According to an economic assessment of water transfers prepared for the California Department of Water Resources, households spend about 15.5% of labor income on retail sales (TCW Economics 2009). Thus, retail purchases associated with operation and maintenance of water storage facilities would increase by about $1.4 million in Contra Costa and San Joaquin Counties.

In 2010, the statewide sales tax rate was 7.5%, of which 1.0% of this total was returned directly to Contra Costa and San Joaquin Counties. Applying the 1.0% local sales tax rate to taxable sales produces an estimate sales tax increase of $140,000 per year.

Substantial increases in local sales tax revenue could then be used to establish new programs and initiatives or bolster existing ones through additional funding. New and improved programs and initiatives could provide benefits to local residents. Therefore, effects associated with permanent increases in State and local sales tax revenues from increases in personal income and purchases would be **beneficial** and **less than significant**.

Mitigation Measure: No mitigation is required.

EFFECT SOCIO-9 **Increases in Property Taxes and Values Associated with Profits from the Sale of Project Water.** *Water-transfer payments presumably would increase average economic returns, thereby increasing property values. Subsequently, reappraisals of farm properties for property tax purposes would occur resulting in increases property tax revenues. Therefore, effects associated with increases in property taxes and values from the sale of project water are beneficial and less than significant.*

Because all four islands would be converted to water storage facilities, profits from the sale of water under Alternative 3 would be greater than Alternatives 1 and 2. Water-transfer payments presumably would increase average economic returns, thereby increasing property values. Reappraisals of farm properties for property tax purposes would likely occur resulting in increases property tax. Subsequently, property tax revenues to Contra Costa and San Joaquin Counties would also increase. Therefore, effects associated with increases in property taxes and values from the sale of project water are **beneficial** and **less than significant**.

Mitigation Measure: No mitigation is required.

EFFECT SOCIO-10 **Economic Effects in the Places of Use Resulting from Improved Water Availability and Reliability.** *Implementation of Alternative 3 would improve water availability and reliability for south-of-Delta water users in the places of use. Therefore, this water supply would create broad economic benefits for regions whose growth is supported by increased deliveries. This effect is beneficial and less than significant.*

Because all four islands would be converted to water storage facilities, more project water would be available for export to the places of use. As discussed above, the specific places of use for project water consist of Semitropic, Metropolitan, Western, and Golden State. Project water that is purchased and used by Semitropic, Metropolitan, and Western ultimately would benefit agriculture in those service areas by supplementing existing agricultural water supplies. Water purchased and used by Western and Metropolitan as well as Golden State would also increase the reliability of existing municipal and industrial deliveries for areas currently served.

Improved water availability and reliability expected to result from implementation of Alternative 3 could potentially increase agricultural production by providing more consistent water supplies, especially in dry years, thereby increasing agricultural production and net income. Under this scenario, it would also be anticipated that employment directly and indirectly associated with agriculture would increase and result in increases in personal income.

Increased municipal and industrial deliveries in the places of use would remove a barrier to growth and would meet water supply demands associated with increased population growth anticipated by each urban water management plan. Subsequently, population growth would stimulate economic activity from increased demand for goods and services. (See Chapter 4, “Other Statutory Requirements,” for a discussion of growth-inducing effects.)

Because the project water would improve water availability and reliability for the Semitropic, Metropolitan, Western, and Golden State water users, this water supply would result in **beneficial** and **less than significant** effects for regions whose growth is supported by increased deliveries.

Mitigation Measure: No mitigation is required.

Table 3.16-21 Delta Wetlands Project SEIS Effects and Mitigation Measures for Socioeconomics
Alternatives 1 and 2 (Proposed Action)
Effect SOCIO-1: Temporary and Short-term Increases in Employment and Personal Income Resulting from Construction-Related Activities (B and LTS) **Mitigation:** No mitigation is required.
Effect SOCIO-2: Temporary and Short-term Increases in Population and Housing Demand Resulting from Construction of Water Storage Facilities (LTS) **Mitigation:** No mitigation is required.
Effect SOCIO-3: Temporary and Short-term Increase in State and Local Sales Tax Revenues from Construction-Related Personal Income and Purchases (B and LTS) **Mitigation:** No mitigation is required.
Effect SOCIO-4: Permanent Effects on Employment and Personal Income Resulting from Operation and Maintenance of Water Storage Facilities (B and LTS for operations and maintenance of water storage facilities; SU for the loss of jobs and personal income associated with the conversion of agricultural uses) **Mitigation:** No feasible mitigation is available.
Effect SOCIO-5: Permanent Increase in Population and Housing Demand Resulting from Operation and Maintenance of Water Storage Facilities (LTS) **Mitigation:** No mitigation is required.
Effect SOCIO-6: Permanent Increases in Spending, Income, and Employment Generated by Recreational Activities on the Project Islands (NI) **Mitigation:** No mitigation is required.
Effect SOCIO-7: Permanent Effects on Agricultural Economics from Idling of Crops on the Project Islands (SU) **Mitigation:** No feasible mitigation is available.
Effect SOCIO-8: Permanent Increase in State and Local Sales Tax Revenues from Personal Income and Purchases (B and LTS) **Mitigation:** No mitigation is required.
Effect SOCIO-9: Increases in Property Taxes and Values Associated with Profits from the Sale of Project Water (B and LTS) **Mitigation:** No mitigation is required.
Effect SOCIO-10: Economic Effects in the Places of Use Resulting from Improved Water Availability and Reliability (B and LTS) **Mitigation:** No mitigation is required.
Alternative 3
Effect SOCIO-1: Temporary and Short-term Increases in Employment and Personal Income Resulting from Construction-Related Activities (B and LTS) **Mitigation:** No mitigation is required.
Effect SOCIO-2: Temporary and Short-term Increases in Population and Housing Demand Resulting from Construction of

Table 3.16-21 Delta Wetlands Project SEIS Effects and Mitigation Measures for Socioeconomics
Water Storage Facilities (LTS) **Mitigation:** No mitigation is required.
Effect SOCIO-3: Temporary and Short-term Increases in State and Local Sales Tax Revenues from Construction-Related Personal Income and Purchases (B and LTS) **Mitigation:** No mitigation is required.
Effect SOCIO-4: Permanent Effects on Employment and Personal Income Resulting from Operation and Maintenance of Water Storage Facilities (B and LTS for operations and maintenance of water storage facilities; SU for the loss of jobs and personal income associated with the conversion of agricultural uses) **Mitigation:** No feasible mitigation is available.
Effect SOCIO-5: Permanent Increase in Population and Housing Demand Resulting from Operation and Maintenance of Water Storage Facilities (LTS) **Mitigation:** No mitigation is required.
Effect SOCIO-6: Permanent Increases in Spending, Income, and Employment Generated by Recreational Activities on the Project Islands (NI) **Mitigation:** No mitigation is required.
Effect SOCIO-7: Permanent Effects on Agricultural Economics from Idling of Crops on the Project Islands (SU) **Mitigation:** No feasible mitigation is available.
Effect SOCIO-8: Permanent Increase in State and Local Sales Tax Revenues from Personal Income and Purchases (B and LTS) **Mitigation:** No mitigation is required.
Effect SOCIO-9: Increases in Property Taxes and Values Associated with Profits from the Sale of Project Water (B and LTS) **Mitigation:** No mitigation is required.
Effect SOCIO-10: Economic Effects in the Places of Use Resulting from Improved Water Availability and Reliability (B and LTS) **Mitigation:** No mitigation is required.
Note: B = Beneficial; NI = No impact; LTS = Less than significant; SU = Significant and unavoidable Source: AECOM 2014

3.16.6 SECONDARY AND CUMULATIVE EFFECTS

Secondary and cumulative socioeconomics effects resulting from implementing the project are presented below and are summarized in Table 3.16-22.

Permanent Effects on Employment and Personal Income Resulting from Operation and Maintenance of Water Storage Facilities

Conversion of the project islands to water storage facilities would directly and indirectly result in the loss of agricultural-related jobs and personal income. The related projects considered in this cumulative effects analysis include a number of projects that would convert agricultural lands to nonagricultural uses. Agricultural land conversions could occur through the urban development of Delta islands, levee improvement and flood control projects, or subsidence reduction programs and these conversions would further contribute to the loss of agricultural-related jobs and personal income in the Delta.

The actual amount of agricultural land that may be converted by other projects is not known; therefore, there is no estimate of overall regional losses of jobs and personal income that would result from implementation of the related projects. However, counties in the project region generally are losing farmland faster than new land is being brought into production and that trend is anticipated to continue (see Section 3.2, "Agricultural Resources," for further discussion). Employment groups sustaining the greatest effects would include on-site farmworkers and losses of jobs and income for businesses that support the agricultural industry, including farm and equipment-supply stores and those that earn their income by selling, transporting, storing, marketing, and processing agricultural products, would occur.

Implementation of Alternatives 1 and 2 would result in the loss of an estimated 99 direct and indirect jobs and result in a loss of an estimated $2.7 million in personal income and implementation of Alternative 3 would result in the loss of an estimated 192 direct and indirect jobs and result in a loss of an estimated $5.2 million in personal income. Overall, these jobs represent a relatively small decrease (0.02%) in the total labor force in Contra Costa and San Joaquin Counties (approximately 824,100 employees). However, the economic effects of crop idling on farmworkers tend to be concentrated within small subgroups of the regional economy, such as those within project islands and other islands in the Delta region. In this instance, if the jobs associated with the small subgroups on the project islands were lost, these job losses could be a substantial adverse effect for these people (U.S. Bureau of Reclamation, California Department of Water Resources, U.S. Fish and Wildlife Service, NOAA Fisheries, and California Department of Fish and Game 2003). When considered in combination with the continued loss of agricultural-related jobs and personal income in the Delta, the project's contribution to these effects is cumulatively considerable.

Mitigation Measure: No feasible mitigation is available.

While a net increase in employment would result from operation and maintenance of water storage facilities, it would not reduce the project's contribution to this effect to a level that is less-than-cumulatively considerable because it cannot be assumed that these jobs would be filled by displaced agricultural workers because the skills required may not comparable. No feasible mitigation is available; therefore, this effect is cumulatively significant and unavoidable.

Permanent Effects on Agricultural Economics from Idling of Crops on the Project Islands

Implementation of the project would convert agricultural land uses to water storage facilities resulting directly in the loss of crop acreage and crop production value. The related projects considered in this cumulative effects analysis include a number of projects that would convert agricultural lands to nonagricultural uses. Agricultural land conversions could occur through the urban development of Delta islands, levee improvement and flood control projects, or subsidence reduction programs. These conversions would further contribute to the loss of crop acreage and crop production value in the Delta.

The actual amount of agricultural land that may be converted by other projects is not known; however, counties in the project region generally are losing farmland faster than new land is being brought into production (see Section 3.2, "Agricultural Resources," for further discussion). Without implementation of the project, the losses of crop acreage and crop production values that have occurred in the region from past projects—and that would continue as a result of present and planned future projects—are considered to be a cumulatively adverse effect. It is unlikely that a similar amount of land in the region with similar qualities and productivity could be brought into production to mitigate the effects resulting from the cumulative loss of crop acreage and crop production values. No feasible mitigation is available to reduce this cumulative effect to a less-than-significant level. The project's contribution to an existing cumulatively adverse effect is cumulatively considerable.

Implementation of Alternatives 1 and 2 would result in the loss of approximately 14,805 acres of crops and an estimated $17.5 million in crop production value and implementation of Alternative 3 would result in the loss of approximately 16,741 acres of crops and an estimated $18.8 million in crop production value. The effects on losses in agricultural production in Contra Costa and San Joaquin Counties would be attenuated by some of the project features and actions, including restoring agricultural production on project islands used for water storage purposes and contributing to the sustainability of in-Delta agriculture through enhancement of levee stability on the project islands (see Chapter 2, "Project Description and Alternatives," for further discussion). However, despite these project-related benefits which would somewhat offset the adverse effects of agricultural land conversion, permanent effects on agricultural economics from idling of crops on the project islands, when considered in combination with other cumulative agricultural land conversion in the Delta, is a cumulatively significant effect.

Mitigation Measure: No feasible mitigation is available.

Restoring project lands to agricultural uses at the conclusion of the project would ensure that permanent conversion of crop acreage and production could be avoided; however, it would not reduce the long-term loss of crop acreage and crop production value during the 50-year life of the project. Therefore, the cumulative effect on agricultural economics resulting from implementation of the Delta Wetlands project and other related projects in the Delta is cumulatively considerable and unavoidable.

Table 3.16-22
Delta Wetlands Project SEIS Summary of Secondary and Cumulative Effects and Mitigation Measures for Socioeconomics

Permanent Effects on Employment and Personal Income Resulting from Operation and Maintenance of Water Storage Facilities (CCU) **Mitigation:** No feasible mitigation is available.
Permanent Effects on Agricultural Economics from Idling of Crops on the Project Islands (CCU) **Mitigation:** No feasible mitigation is available.
Note: CCU = Cumulatively considerable and unavoidable Source: AECOM 2014

3.17 TRAFFIC AND TRANSPORTATION

3.17.1 INTRODUCTION

This section describes recent changes to the existing environmental conditions and regulatory framework of the project study area, summarizes the unchanged affected environment, and describes changed environmental effects related to traffic and transportation for the project. A review and update of the 1995 DEIR/EIS traffic and navigation assessment was incorporated in the 2001 FEIS. Chapter 3L in the 2001 FEIS provided detailed information regarding traffic and navigation associated with the project and in the Sacramento-San Joaquin Delta (Delta) in general. The traffic and navigation effects of the project were analyzed most recently in Section 4.10 and Chapter 5 of the 2010 DEIR, which also served as a basis for this analysis. The 1995 DEIR/EIS, 2001 FEIS, and 2010 DEIR are herein incorporated by reference.

The 2001 FEIS concluded that the project alternatives would adversely affect traffic and transportation on and in the vicinity of the four project islands. Since that time, there have been minor changes in the "Affected Environment" and "Regulatory Framework/Applicable Laws, Regulations, Plans, and Policies" subsections. However, there have been no changes in the project that result in new significant adverse environmental effects or a substantial increase in the severity or intensity of previously identified effects on traffic and transportation.

The 2001 FEIS traffic analysis has been updated here to reflect existing conditions (2008); and to analyze future years 2012 (expected built-out year) and 2030 (long-range planning year). This SEIS has been prepared in 2013, and relies on traffic modeling that was prepared by ICF in 2008 for the 2010 DEIR. Due to the economic downtown that occurred after the traffic modeling was prepared in 2008, the traffic modeling is still considered to be valid for this analysis in 2013 because the rate at which new development is occurring has substantially slowed. Therefore, the traffic modeling overestimates the projected traffic volumes and is thus extremely conservative. This section presents a summary of the transportation infrastructure and traffic conditions in the project vicinity and addresses the effects of the project on the surrounding transportation system.

Identification of the project's specific places of use does not affect traffic and transportation in any way that alters the conclusions of the 2001 FEIS. The project would not have any direct adverse effects on traffic and transportation in the places of use; the effects on traffic and transportation, if any, associated with the provision of project water to the places of use are addressed in the "Secondary and Cumulative Effects" subsection below and in Chapter 4, "Other Statutory Requirements."

SUMMARY OF CHANGES, NEW CIRCUMSTANCES, AND NEW INFORMATION

While there is new information related to traffic and navigation, which is described below, these changes are minor and would not result in new significant adverse effects or increase the severity or intensity of previously identified adverse effects.

Substantial Changes in the Project

Since the 2001 FEIS was completed, there have been no substantial changes to the project resulting in new significant adverse effects or substantial increase in the severity or intensity of effects on traffic and transportation. However, the project no longer includes a proposal to construct new recreation facilities on the Reservoir or Habitat Islands; this change to the project results in a reduction and/or elimination of some the previously identified environmental effects.

New Circumstances

Since the 2001 FEIS was completed, there have been no new circumstances pertinent to the traffic and transportation analysis resulting in new significant adverse effects or substantial increase in the severity or intensity of previously identified effects.

New Information

There is no new information of substantial importance that would result in an increase in the severity or intensity of effects on traffic and transportation. However, since the publication of the 2001 FEIS, various agencies have adopted a number of new plans and policies that affect the transportation system in the project study area. New studies have been conducted, and updated information became available regarding the use of the transportation system. Specifically, this section has been revised to include updated information as described below.

- The latest relevant plans and policies were reviewed to ensure that the methods used to analyze existing and future transportation conditions were appropriate. In particular, the revised analysis is consistent with adopted level of service (LOS) standards, prescribed LOS methodologies, and development review regulations.

- The existing roadway traffic and navigational boating conditions were updated to reflect the latest data available.

- Planned roadway improvements identified in the area were reviewed to ensure that they were appropriately accounted for in the analysis.

This section also has been updated to reflect existing conditions as of 2008, and future years 2012 (for project built-out year) and 2030 (for the long-term planning horizon). Regional growth projections have been updated accordingly.

SUMMARY OF ENVIRONMENTAL COMMITMENTS

Environmental commitments are measures incorporated by the project applicant as part of the project, meaning they are proposed as elements of the Proposed Action and are therefore considered in conducting the environmental analysis for each resource area of this SEIS. The purpose of environmental commitments is to reflect and incorporate best practices into the project that avoid, minimize, reduce, or offset potential environmental effects. A complete description of the environmental commitments that have been incorporated into the project since the 2001 FEIS is contained in Chapter 2, “Project Description and Alternatives,” of this SEIS. The environmental commitments that are relevant to traffic and transportation are described below.

Coordinate with California Department of Transportation Regarding Wilkerson Dam

If Alternative 3 is implemented, the project will consult with and obtain all required permits and approvals from the California Department of Transportation (Caltrans) for the design and construction of Wilkerson Dam prior to the start of project-related construction activities.

3.17.2 AFFECTED ENVIRONMENT

This section describes the existing roadway and waterway system and traffic conditions on and in the vicinity of the project islands. An approximate 10-mile radius around the project islands was used as the geographic scope for the traffic analysis. Information on the roadway system and traffic conditions is based, in part, on information collected for the 2001 FEIS. The information has been updated to reflect existing conditions as of 2008.

Sources of information used to document existing conditions include all the sources listed in the 2001 FEIS (such as data, reports, and conversations with the California Department of Boating and Waterways, the California State Lands Commission, San Francisco Estuary Project, State Water Board, the Delta Protection Commission, and Delta marina operators). Additional data used in this revised analysis were compiled from the following sources: Caltrans, San Joaquin Council of Governments (SJCOG), Contra Costa Transportation Agency (CCTA), counties of San Joaquin and Contra Costa, cities of Oakley and Brentwood, Delta Ferry Authority, and California Department of Boating and Waterways.

EXISTING ROADWAY SYSTEM

The Delta is served by a network of county roads, private roads, and state highways. Regional highways serving the project vicinity are Interstate 5 (I-5), State Routes (SRs) 12, 4, and 160. In addition, ferries provide transportation between islands that do not have bridges. Transportation facilities in the project study area are described below and are shown in Exhibit 3.17-1.

Bouldin Island

SR 12 crosses the north side of Bouldin Island, providing access to Fairfield and Napa to the west and extending to Lodi and the Sierra Nevada foothills to the east. On the island, SR 12 is a narrow-shouldered, two-lane highway across the island bottom, at 10–15 feet below the water level in the exterior channels. In addition to SR 12, several narrow private interior roads provide access to agricultural operations on the island.

At the east end of Bouldin Island, SR 12 crosses Little Potato Slough on a two-lane swing bridge that has an approximately 35-foot clearance for boats. The speed limit is 55 miles per hour (mph) on this segment of SR 12. Access to the private dirt levee roads on Bouldin Island north and south of SR 12 is available approximately 0.25 mile west of the bridge. At the west end of the island, SR 12 crosses the Mokelumne River on a swing bridge.

Webb Tract

No roads provide access to Webb Tract; the Jersey-Bradford-Webb ferry, operated by the Delta Ferry Authority, provides ferry service to Webb Tract and Bradford Island from Jersey Island. Private interior roads exist on Webb Tract to enable vehicles to circulate once they are on the island.

Jersey Island Road provides access to the ferry on Jersey Island. Jersey Island Road is a narrow, two-lane road with narrow shoulders and a posted speed limit of 25 mph. It crosses Jersey Island and then winds along the narrow levee the final 3 miles to the ferry landing.

Cypress Road provides access to Jersey Island Road from SR 4 and the city of Oakley. It is a two-lane arterial, with a posted speed limit of 50 mph. Planned future improvements, as outlined in the City's Long Range Roadway Plan (City of Oakley 2002), include widening the current roadway to a six-lane arterial between Sellers Avenue and Jersey Island Road.

The Delta Ferry Authority operates the Jersey-Bradford-Webb ferry each hour from 8 a.m. to 5 p.m., Monday through Friday, and half days on weekends. During fiscal year 2006–2007, the total number of passengers using the ferry was 6,440 (California Office of the Controller 2008).

Based on this figure, average use for that year is estimated to have been approximately 25 passenger trips per day (approximately 6,440 trips/260 days). The ferry system is funded through the Delta Ferry Authority. The Delta Ferry Authority is composed of Reclamation District No. 2026 (Webb Tract) and Reclamation District No. 2059 (Bradford Island).

Holland Tract

Just north of the city of Brentwood in Contra Costa County, the east-west Delta Road turns north, crosses Rock Slough on a two-lane bridge, and becomes Holland Tract Road. Holland Tract Road is a narrow, two-lane levee road that enters the southwest corner of Holland Tract. Access northward on the west levee is blocked by a locked gate. To the east, the county road runs along the southern levee to the Holland Tract Marina, located at the southeast corner of the island. At the marina, the county road ends at a locked gate. In 1993, the Contra Costa County Department of Public Works abandoned responsibility for those sections of Holland Tract Road along the east and west perimeter levees beyond the locked gates; these are now private roads. The posted speed limit is 35 mph on the public access portion of Holland Tract Road on the southern perimeter levee and is 25 mph at the marina. Additionally, private interior roads provide access to agricultural operations on the island.

Bacon Island

Bacon Island Road, the only public road to Bacon Island, provides access from SR 4 to Bacon Island from the east. As it approaches Bacon Island, Bacon Island Road is a narrow, two-lane, east-west road with narrow shoulders, and posted speed limits range from 15–30 mph. Access to Bacon Island via Bacon Island Road is provided by the Bacon Island Bridge, a 2-lane swing bridge over Middle River built in 1995.

On Bacon Island, Bacon Island Road is a narrow, winding, north-south levee road with a posted speed limit of 25 mph. Bacon Island Road provides access to the Bullfrog Landing Marina and agricultural properties on the island. The public portion of Bacon Island Road ends at the north end of Bacon Island at a bridge to Mandeville Island. Beyond the bridge, a private dirt/gravel road extends to the western edge of Bacon Island.

SR 4 provides access from Bacon Island Road east to Stockton and the Sierra Nevada foothills and west to Brentwood and Antioch. SR 4 is a two-lane, east-west highway with wide shoulders. SR 4 is a levee-top road at its intersection with Bacon Island Road.

EXISTING TRAFFIC CONDITIONS

The following roadway segments were chosen for evaluation because they are located at the major access points to each island. The location of these roadway segments are shown on Exhibit 3.17-1.

- Bouldin Island
  - SR 12 west of Terminus

- Webb Tract
  - SR 4 south of Cypress Road
  - Cypress Road west of Jersey Island Road
  - Jersey Island Road north of Dutch Slough Road

- Holland Tract
  - SR 4 south of Delta Road
  - Byron Highway south of Delta Road
  - Delta Road east of Byron Highway

- Bacon Island
  - SR 4 east of Tracy Boulevard
  - Bacon Island Road at the Bacon Island Road Bridge
  - Lower Jones Road north of Cook Road

For each of these roadway segments, traffic volumes (daily and peak-hour directional counts) were assembled from various sources. On state highways, Caltrans provides annual traffic count reports (California Department of Transportation 2009). Contra Costa County and San Joaquin County Public Works Departments provided data on county roadways. Data for Cypress Road and Jersey Island Road were obtained from the City of Oakley.

Original traffic volume data was collected on different years, with the oldest data dating from 2002. All state highway data is from 2008. For this analysis, all traffic volume data were converted to 2008 data using appropriate growth rates (based on historical trends).

Based on 2008 traffic volumes, an analysis of roadway LOS was conducted on all studied roadway sections. The LOS analysis was performed using the methods outlined in the Highway Capacity Manual (HCM) published by the Transportation Research Board (TRB) in 2000 for 2-lane highway operations.

The HCM methods estimate measures of traffic operation along a section of a two-lane highway based on terrain, geometric design, and traffic conditions. Criteria for 2-lane highway LOS are shown in Table 3.17-1. On major 2-lane highways (Class I), both percent time following and average travel speed are used to define LOS; on highways where accessibility is paramount and mobility is less critical (Class II), LOS is defined only in terms of percent time spent following, without consideration of average travel speed.

Table 3.17-1
Level of Service Criteria for Two-Lane Highways

	Class I[1]		Class II[2]
Level of Service	Percent Time Spent Following[3]	Average Travel Speed	Percent Time Spent Following[3]
A	≤ 35	> 55	≤ 40
B	> 35–50	> 50–55	> 40–55
C	> 50–65	> 45–50	> 55–70
D	> 65–80	> 40–45	> 70–85
E	> 80	≤ 40	> 85
F	N/A[4]	N/A[4]	N/A[4]

Notes: ≤ = less than or equal to; > = greater than; N/A = not applicable

[1] Class I highways are major intercity routes that serve long distance trips (e.g., primary arterials and state highways).

[2] Class II highways are access, scenic, or recreational routes.

[3] Percent time spent following is the average percentage of travel time that vehicles must travel in platoons behind slower vehicles because of the inability to pass.

[4] LOS F applies whenever the flow rate exceeds the segment capacity.

Source: ICF 2010:4.10-13; adapted by AECOM in 2013

Table 3.17-2 shows the existing peak-hour volumes (in 2008) and corresponding LOS of analysis road segments. The table also indicates the adopted LOS standards for each segment, based on sources identified in the "Regulatory Framework/Applicable Laws, Regulations, Plans, and Policies" subsection.

All of the segments currently operate at or above the relevant adopted LOS standard, except for the section of SR 12 west of Terminus, which operates at LOS E under existing conditions.

Table 3.17-2 Existing Peak-Hour Volumes and Level of Service					
Roadway Segment Location	Peak-Hour Volume[1]	Existing LOS	V/C	LOS Standard[2]	Source[3]
SR 4 south of Cypress Road	1,150	D	0.39	E	Contra Costa Transportation Agency 2009
SR 4 south of Delta Road	1,300	E	0.44	E	Contra Costa Transportation Agency 2009
SR 4 east of Tracy Boulevard	790	D	0.27	D	San Joaquin County Council of Governments 2007a
SR 12 west of Terminus	1,850	**E**	0.62	D	San Joaquin County Council of Governments 2007a
Bacon Island Road at the Bacon Island Road Bridge	80	A	0.03	C	San Joaquin County 1992
Lower Jones Road north of Cook Road	40	A	0.01	C	San Joaquin County 1992
Jersey Island Road north of Cypress Road	60	A	0.02	D	City of Oakley 2010
Cypress Road west of Jersey Island Road	720	C	0.25	D	City of Oakley 2010
Byron Highway south of Delta Road	130	A	0.05	High C	Contra Costa County 2005
Delta Road east of Byron Highway	50	A	0.02	High C	Contra Costa County 2005

Notes: SR = State Route; LOS = level of service; V/C = volume-to-capacity ratio; bold text indicates an exceedance of a LOS standard

1 Peak-hour volume is the highest sum of the volumes (both directions) during a peak hour of the day.

2 LOS standard based on adopted plans and policies (see “Regulatory Framework/ Applicable Laws, Regulations, Plans, and Policies” subsection).

3 Indicates source for LOS standard.

Sources: ICF 2010:4.10-14 and AECOM 2014

PLANNED ROADWAY IMPROVEMENTS

Several roadway improvements are planned on and near the studied roadways in the near term (2012) and long term (2030). Only the funded projects were incorporated into this analysis of future traffic conditions.

Funded Roadway Projects

State Route 4 Bypass

The SR 4 Bypass project is a roadway project being developed by a cooperative effort between Contra Costa County and the cities of Antioch, Brentwood, and Oakley to ease traffic congestion through the Brentwood and Oakley areas. This project will create a new four-lane at-grade divided freeway with interchanges at Lone Tree Way, Sand Creek Road, Balfour Road, Marsh Creek Road, and Walnut Boulevard. The bypass will replace existing SR 4 from just south of the Main Street interchange to the existing intersection with Marsh Creek Road. As of 2010, the project was completed.

Operational and Intersection Improvements on State Route 4 between Daggett Road and Interstate 5 (Posted Mile 12.6/15.9)

This project is shown as a Tier I priority in the 2007 Regional Transportation Plan (San Joaquin Council of Governments 2007a, 2007b). Construction is expected to be completed by 2014.

Extension and New Alignment of State Route 4 between Fresno Avenue and East of Daggett Road

The project is shown as a Tier I priority in the 2007 Regional Transportation Plan (San Joaquin Council of Governments 2007a, 2007b). The project is expected to be open to traffic in 2016.

Safety and Operational Improvements on State Route 12 between the San Joaquin County Line and Interstate 5

Caltrans is designing and constructing safety and operational improvements to include roadway realignment, profile correction, shoulder widening, centerline and shoulder rumble strips, intersection improvements, and extended passing lanes. Improvements between I-5 and Bouldin Island are listed as a Tier I priority in the 2007 Regional Transportation Plan (San Joaquin Council of Governments 2007a). The project is expected to be open to traffic in 2017.

Unfunded Roadway Projects

Certain planned, but currently unfunded, roadway projects are discussed below because implementation of these planned projects would improve the LOS on several project area roadways.

State Route 12 Widening

Caltrans 2030 concept for SR 12 is a four-lane facility with a concrete barrier between Rio Vista Bridge and I-5, as described in the SR 12 Comprehensive Transportation Corridor Study (California Department of Transportation 2006). It was recognized that the project is in environmentally sensitive areas west of the Potato Slough Bridge that could cause construction to be significantly more expensive because of soil conditions and environmental concerns. This project is not currently programmed or funded.

State Route 4 Widening between the San Joaquin County Line and Interstate 5

Caltrans Transportation Concept Report (California Department of Transportation 2002) calls for a four-lane, conventional facility with passing lanes and left turn pockets as the 2020 concept. This project is not currently programmed or funded.

State Route 4 Widening through Oakley

This project is included in the City of Oakley General Plan Circulation Element (City of Oakley 2010). The project involves the expansion of Main Street (existing SR 4) to major arterial standards (four to six lanes with median) from SR 160 to the southern city limit. This project is not currently programmed or funded, with the exception of the widening of Main Street between Laurel Road and Hill Avenue, which is included in the City's Capital Improvement Program for Fiscal Years 2006/07 to 2010/11 (City of Oakley 2006). The City of Oakley has proposed that the existing non-freeway portion of SR 4 from the SR 160 interchange to Delta Road be relinquished from Caltrans to the local agency, and that the state route be transferred to the new SR 4 Bypass facility.

Cypress Road Widening in Oakley

As outlined in the City's Long Range Roadway Plan (City of Oakley 2002), the project includes widening of the current roadway to a six-lane arterial between Sellers Avenue and Jersey Island Road to accommodate the expected traffic growth. This project is not currently programmed or funded.

WATERWAY TRAFFIC AND SAFETY

Boat-related recreational activity in the Delta has increased over recent years. Approximately 806,960 boats are registered in California (California Department of Motor Vehicles 2011). Of these, approximately 32,384, or 4.0%, are registered in Contra Costa County, and 23,597, or 2.9%, are registered in San Joaquin County. Boating traffic in the Delta consists of recreational, commercial, residential, and emergency service traffic. Fisherman's Cut and False River, for example, are used to transport large barges, tugs, cranes, and other types of equipment. Bradford Island residents use the channels to commute to work and to shopping locations. Law enforcement and fire response services via boats also use the waterways for emergency response to various locations in the Delta.

Fog is common during the winter months throughout the Delta. Fog may sometimes settle low on bodies of water (i.e., Delta channels) when there is little or no wind, creating a dense fog condition in that localized area, making marine navigation difficult. However, according to the U.S. Coast Guard, the level of boating activity and the need for search and rescue efforts during the winter months are relatively low compared with the need in summer months (ICF 2001:3L-5). However, boaters who use the Delta in the winter generally are experienced in boating, carry navigational equipment, and are familiar with marine navigation in foggy weather (ICF 2001:3L-5).
The Delta Vision Strategic Plan recently released by the Governor's Blue Ribbon Task Force (Blue Ribbon Task Force 2008) includes a recommendation to reconfigure Delta waterway geometry by 2015 to increase variability in estuarine circulation patterns. These reconfigurations should be planned in conjunction with near-term and long-term conveyance modifications. These reconfigurations will include installing removable or operable flow barriers, especially in channels of the south Delta, so that channel lengths are greater than tidal excursion distances. These modifications should allow for continued navigation.

NON-MOTORIZED TRANSPORTATION

The project study area consists of two-lane rural roads. No facilities are provided for bicycles or pedestrians except within nearby urban areas in the cities of Oakley and Brentwood and at new developments near the project study area.

PUBLIC TRANSIT

Tri Delta Transit provides public transit service in Brentwood and Oakley weekdays between 6 a.m. and 8 p.m. in 30-minute headways. Saturday service is provided in 60-minute headways between 9 a.m. and 5 p.m. Tri Delta Transit provides express bus service connecting Brentwood and Oakley to the Pittsburg/Bay Point BART station, using SR 4. A local service route (#386) also connects Brentwood with Byron and Discovery Bay. However, there is no bus service to the project islands.

3.17.3 REGULATORY FRAMEWORK/APPLICABLE LAWS, REGULATIONS, PLANS, AND POLICIES

Federal applicable laws and regulations are provided because they are required under NEPA. State applicable laws and regulations are provided for informational purposes and to assist with NEPA review. Local applicable policies are provided because they form the basis of the traffic and transportation effects analysis. USACE has considered applicable state, regional, and local plans and ordinances as a part of the environmental review process for this SEIS, where applicable.

FEDERAL

There are no Federal laws, regulations, plans, or policies applicable to traffic and transportation that would apply to the Proposed Action or alternatives under consideration.

STATE

Caltrans is responsible for planning, designing, constructing, operating, and maintaining all state-owned roadways in San Joaquin and Contra Costa Counties. Caltrans implements Federal highway standards in California.

3.17.4 ANALYSIS METHODOLOGY

TRAFFIC PROJECTION METHODS

Development of Future No-Project Traffic Volumes

The future no-project traffic conditions represent traffic levels that would exist in the study area if the project is not implemented and the intensified agricultural activities associated with the No-Action Alternative do not occur. Future no-project conditions are used as a basis for comparison to determine the increment of change directly related to the implementation of the project.

Future no-project traffic volumes were developed for the expected project buildout year (2012) and for the long-range planning horizon (2030). The traffic forecasts were generally based on existing volumes and annual traffic growth rate assumptions reflecting historical trends. In and near the City of Oakley, the 2030 baseline traffic volume projections were derived from the City's Long Range Roadway Plan (City of Oakley 2002).

For the state highway sections (outside of Oakley), the annual traffic growth rate used to project future volumes is based on a comparison of Caltrans field measurements between 1988 and 2008. On these facilities, the annual growth rate that was observed in the last 20 years is assumed to continue in the coming 20 years. An annual growth rate of 1.0% was used for SR 12 (west of Terminus); an annual growth rate of 1.1% was used for SR 4 east of Tracy Boulevard.

For the county roadway sections, annual growth rates were derived from a comparison of two sets of counts. Observed annual growth rates typically vary between 1% and 2%. A conservative 2% annual growth rate was used to project future traffic volumes on Bacon Island Road, Byron Highway, and Delta Road.

For the SR 4 sections within the city of Oakley, Jersey Island Road, and Cypress Road, the 2012 baseline projections also are based on continuation of historical trends (annual growth rates varying between 1.0% and 2.8%); however, the 2030 projections are based on the City of Oakley Long Range Roadway Plan, which better captures expected future changes in land use and transportation conditions in the area. The Long Range Roadway Plan presents traffic forecasts based on CCTA's East County Travel Demand Model. This subregional model forecasts traffic volumes based on population and employment projections and assumptions on future improvements to the transportation system. The model was used to estimate traffic volumes assuming the cumulative effects of the buildout of the Oakley General Plan Preferred Alternative, as well as growth in neighboring cities, consistent with their current adopted General Plans. The model also captures the effect of the SR 4 Bypass, which lowers the increase of traffic along the existing SR 4.

Development of With-Project Traffic Volumes

Trip Generation

Sources of traffic generated by the project would consist of agricultural operations and project maintenance activities.

Harvest vehicle trips are distinguished from non-harvest agricultural trips by the fact that harvest trips are made to deliver harvested crops. Non-harvest agricultural trips include all other agricultural trips.
Agriculture- and construction-related trip generation estimates provided by the project applicant were used to estimate vehicle trips. Overall vehicle trips generated by the three action alternatives are presented in Table 3.17-3 and boat use-days for project operation and maintenance that would be generated by the three action alternatives on peak days are presented in Table 3.17-4.

Peak-hour vehicle trips are vehicle trips made during the hour of the day with the greatest traffic volume. Commonly, an approximately 10:1 relationship exists between daily traffic and peak-hour volumes. Therefore, it was assumed that 10% of daily trips, presented in Table 3.17-5, would operate during the peak hour. Table 3.17-5 shows peak-hour vehicle trip generated from construction and operation activities for each of the action alternatives.

Trip Distribution and Assignment

Trips generated by the project were assigned to the roadway system. The project trip distribution and assignment assumptions represent the most logically traveled routes for traffic that would be accessing the project. The following assumptions were used to distribute project traffic among area roadways:

- 50% of all trips generated by the project are assumed to access each island from the west, and the other 50% of trips would access from the east;
- for the Bacon Island site, 100% of all project generated trips are assumed to access the site using Bacon Island Road (rather than Lower Jones Road);
- for the Holland Tract site, 50% of all project generated trips are assumed to access the site via Delta Road, and the other 50% of trips would use Byron Highway.

The first and third assumptions listed above are based on the understanding that there are population centers and appropriate work forces located both east and west of the project area and the assumption that it is equally likely that project workers would come from one direction as from the other. The second assumption is based on the fact that Bacon Island Road is the more direct and faster route to access Bacon Island from SR 4. These assumptions are based on existing traffic patterns. Table 3.17-6 summarizes the peak hour trip assignment to roadway segments analyzed herein for the three action alternatives.

Development of No-Action Alternative Traffic Volumes

As described in Chapter 2, “Project Description and Alternatives,” the No-Action Alternative involves intensified agricultural activities and is not the same as future no-project conditions. The No-Action Alternative also involves the implementation of an intensive for-fee hunting program. The expanded hunting program would include both upland game and waterfowl.

Trip Generation

Sources of traffic under No-Action Alternative conditions include recreational activities (from the proposed for-fee hunting program) and agricultural activities. Although agricultural and recreation-related activities are not expected to peak during the same months, all sources of traffic were combined to ensure that the worst-case analysis was analyzed.

Trip generation estimates for agricultural activities associated with the No-Action Alternative were provided by the project proponent and are shown in Table 3.17-7.

Table 3.17-3
Daily Vehicle Trip Generation from Project Construction, Operation, and Maintenance

Vehicle Type	Season	Bouldin Island		Webb Tract		Holland Tract		Bacon Island	
		Alt 1 or 2	Alt 3	Alt 1 or 2	Alt 3	Alt 1 or 2	Alt 3	Alt 1 or 2	Alt 3
Daily Vehicle Trip Generation from Project Construction									
Worker vehicle trips to islands		30	151	53	53	14	103	67	67
Worker vehicle trips to boats[1]		1	7	31	31	1	4	3	3
Delivery truck trips to islands		0	1	2	2	0	1	2	2
Total daily construction vehicle trips		**31**	**159**	**86**	**86**	**15**	**108**	**72**	**72**
Daily Vehicle Trip Generation from Project Operation and Maintenance									
Harvest vehicles trips		1	0	0	0	1	0	0	0
Nonharvest vehicle trips		0	0	0	0	5	0	0	0
Maintenance vehicle trips		14	27	25	25	15	41	33	33
Maintenance vehicle trips to boats[1]		1	2	8	8	1	2	2	2
Total daily operation vehicle trips		**16**	**29**	**33**	**33**	**22**	**43**	**35**	**35**

Note:

1 Number of vehicle trips made to boats (other than ferry) that carry workers to islands.

Sources: ICF 2010:4.10-22 and AECOM 2014

Table 3.17-4
Boat Use-Days from Project Construction, Operation, and Maintenance

Boat Type	Season	Bouldin Island		Webb Tract		Holland Tract		Bacon Island	
		Alt 1 or 2	Alt 3	Alt 1 or 2	Alt 3	Alt 1 or 2	Alt 3	Alt 1 or 2	Alt 3
Daily Boat Trip Generation from Project Construction									
Barge trips to islands		1	1	1	1	0	1	1	1
Worker boat trips to islands		2	12	12	12	2	16	3	3
Total daily construction boat trips		**3**	**13**	**13**	**13**	**2**	**17**	**4**	**4**
Peak Day Boat Use Days from Project Operation and Maintenance									
Agriculture boat trips		0	0	0	0	0	0	0	0
Maintenance boat trips to islands		1	1	3	3	1	2	1	1
Total operation boat use-days		1	1	3	3	1	2	1	1

Sources: ICF 2010:4.10-23 and AECOM 2014

Table 3.17-5 Peak-Hour Vehicle Trip Generation, Construction and Operational Phases				
	Construction		Operation and Maintenance	
Project Island	Alternative 1 or 2	Alternative 3	Alternative 1 or 2	Alternative 3
Bouldin Island	3	16	2	3
Webb Tract	9	9	3	3
Holland Tract	1	11	2	4
Bacon Island	7	7	4	4
Total	**20**	**43**	**11**	**14**

Sources: ICF 2010:4.10-24 and AECOM 2014

Table 3.17-6 Peak-Hour Trip Assignment to Roadway Segments, Construction and Operational Phases				
	Construction		Operation and Maintenance	
Roadway Segment Location	Alternative 1 or 2	Alternative 3	Alternative 1 or 2	Alternative 3
SR 4 south of Cypress Road	9	14	4	5
SR 4 south of Delta Road	9	14	4	5
SR 4 east of Tracy Boulevard	9	14	4	5
SR 12 west of Terminus	2	8	1	2
Bacon Island Road at the Bacon Island Road Bridge	7	7	3	4
Lower Jones Road north of Cook Road	0	0	0	0
Jersey Island Road north of Cypress Road	9	9	3	4
Cypress Road west of Jersey Island Road	9	9	3	4
Byron Highway south of Delta Road	1	6	1	1
Delta Road east of Byron Highway	1	6	1	1

Notes: SR = State Route

Sources: ICF 2010:4.10-25 and AECOM 2014

Table 3.17-7 Daily Vehicle and Boat Trips under the No-Action Alternative				
Number of Daily Trips	Bouldin Island	Webb Tract	Holland Tract	Bacon Island
Vehicle trips to recreation areas	42	38	29	43
Harvest vehicle trips	13	4	3	62
Nonharvest agricultural vehicle trips	56	64	23	46
Total Vehicle Trips	**111**	**106**	**55**	**151**
Agricultural boat trips	0	10	0	0
Total Boat Trips	**0**	**10**	**0**	**0**

Sources: ICF 2010:4.10-26 and AECOM 2014

Recreational trip generation estimates were calculated based on the number of hunter use-days (ICF 2001: Chapter 3J and ICF 1995:Chapter 3J, herein incorporated by reference). Recreational trip generation estimates account for implementation of the intensive for-fee hunting program. The resulting daily trips by vehicles and by boats for the No-Action Alternative are shown in Table 3.17-7.

Peak-hour vehicle trips are vehicle trips made during the hour of the day with the greatest traffic volume. Commonly, an approximately 10:1 relationship exists between daily traffic and peak-hour volumes. Therefore, it was assumed that 10% of daily trips, presented in Table 3.17-7, would operate during the peak hour.

Trip Distribution and Assignment

Trips generated under the No-Action Alternative were assigned to the roadway system. Trip distribution and assignment assumptions represent the most logically traveled routes for recreational and agricultural traffic accessing the facilities. The following assumptions were used to distribute access traffic among area roadways:

- 50% of all trips generated by the project are assumed to access each project island from the west, and the other 50% of trips would access from the east;
- for the Bacon Island site, 100% of all project-generated trips are assumed to access the site using Bacon Island Road (rather than Lower Jones Road);
- for the Holland Tract site, 50% of all project-generated trips are assumed to access the site via Delta Road, and the other 50% of trips would use Byron Highway.

The first and third assumptions above are based on the understanding that there are population centers and appropriate work forces located both east and west of the project area and the assumption that it is equally likely that recreationists would come from one direction as from the other. The second assumption is based on the fact that Bacon Island Road is the more direct and faster route to access Bacon Island from SR 4. These assumptions are based on existing traffic patterns. Table 3.17-8 summarizes the peak hour trip assignment to the roadway segments analyzed herein for the No-Action Alternative.

Table 3.17-8
Peak-Hour Trip Assignment to Roadway Segments for the No-Action Alternative

Roadway Segment Location	No-Action Alternative Operations[1]
SR 4 south of Cypress Road	27
SR 4 south of Delta Road	27
SR 4 east of Tracy Boulevard	27
SR 12 west of Terminus	10
Bacon Island Road at the Bacon Island Road Bridge	23
Lower Jones Road north of Cook Road	0
Jersey Island Road north of Cypress Road	19
Cypress Road west of Jersey Island Road	19
Byron Highway south of Delta Road	6
Delta Road east of Byron Highway	6

Notes: SR = State Route

[1] The No-Action Alternative does not entail any construction activity.

Source: ICF 2010:4.10-27; adapted by AECOM in 2013

SIGNIFICANCE CRITERIA

The basis for determining the significance of effects for this analysis is based on professional standards, project-specific criteria developed by the lead agency to address potential effects unique to the project's location and elements, and is informed by the criteria contained in the Environmental Checklist in Appendix G of the State CEQA Guidelines. These thresholds encompass the factors taken into account under NEPA to determine the significance of an action in terms of its context and the intensity of its effects. The Proposed Action or alternatives under consideration would have a significant adverse effect on traffic and transportation if they would do any of the following:

- cause an increase in traffic that is substantial in relation to the existing traffic load and capacity of the street system (i.e., result in a substantial increase in either the number of vehicle trips, the volume to capacity ratio on roads, or congestion at intersections);
- exceed, either individually or cumulatively, an LOS standard established by the Contra Costa County Congestion Management Agency;
- substantially increase hazards because of a design feature (e.g., sharp curves, dangerous intersections) or incompatible uses (e.g., farm equipment);
- result in inadequate emergency access; or
- conflict with adopted policies, plans, or programs supporting alternative transportation (e.g., bus turnouts, bicycle racks).

Other criteria for determining the significance of effects that were used in this analysis consist of the following:

- **Effects on traffic safety.** The Proposed Action or alternatives under consideration are considered to have a significant adverse effect if they would result in the operation of additional large trucks or other equipment on Delta roadways during construction or operation, compared with future no-project conditions. Conversely, the Proposed Action or alternatives under consideration are considered to have a beneficial effect if they would result in the removal of any large trucks or other equipment from operation on Delta roadways during construction or operation, compared with future no-project conditions.
- **Effects on traffic circulation and access.** The Proposed Action or alternatives under consideration are considered to have a significant adverse effect if they would limit access to the project islands or along haul routes during construction. The Proposed Action or alternatives under consideration are also considered to have a significant adverse effect if they would alter circulation patterns on highways in the project vicinity during construction or operation.
- **Effects on waterway traffic and safety.** The Proposed Action or alternatives under consideration are considered to have a significant adverse effect on waterway traffic or safety if they would:
  - adversely affect boat navigation in Delta waterways by altering physical conditions in a channel;
  - involve the permanent placement of an obstruction greater than one-third the width of the channel in waterways surrounding the project islands during construction or operation; or
  - increase the potential for boating accidents to occur in waterways surrounding the project islands during project construction or operation.

Because Bacon and Bouldin Islands are located in San Joaquin County, and Webb and Holland Tracts are located in Contra Costa County, the local regulations established by San Joaquin and Contra Costa Counties that pertain to the islands that fall within their respective boundaries. Therefore, the following criteria were also used in determining the significance of effects in this analysis:

San Joaquin County General Plan

The 1992 General Plan (San Joaquin County 1992) established the county's traffic LOS policy. On minor arterials and roadways of higher classification (not including freeways, which are treated separately in the CMP), San Joaquin County adopted the following LOS roadway standards:

- LOS D on state highways;
- LOS D within a city's sphere of influence, or LOS C when the city plans for that level of service or better; and
- LOS C on other roads.

LOS is measured using standards defined by the HCM (Transportation Research Board 2000) or the state.

Exceedance of the established LOS would result in an adverse effect.

Contra Costa County General Plan

The 2005–2020 Contra Costa County General Plan (Contra Costa County 2005), Chapter 4 Growth Management Element, indicates that each jurisdiction within the county must adopt Traffic LOS standards keyed to types of land use as follows:

- Rural: low C
- Semi-Rural: high C
- Suburban: low D
- Urban: high D
- Central Business District (CBD): low E

LOS would be measured by Circular 212 or the method described in the most commonly used version of the HCM (Transportation Research Board 2000).

Figure 4-2 of the General Plan shows the LOS designations for unincorporated areas. Land use designations for study roadways within the project vicinity are:

- Cypress Road: urban (within Oakley city limits) then suburban;
- Jersey Island Road: suburban (in Hotchkiss Tract) then semi-rural (on Jersey Island); and
- Delta Road, Holland Tract Road, and Byron Highway: semi-rural.

Exceedance of the established LOS would result in an adverse effect.

Future No-Project Traffic Conditions

Future Level of Service

Table 3.17-9 summarizes the expected peak hour traffic volumes and resulting LOS projected on the studied roadway segments under future no-project conditions (2012 and 2030).

Among the projects described above under "Planned Roadway Improvements" in the "Affected Environment" subsection, only the funded projects were incorporated into the analysis of future no-project traffic conditions reported in Table 3.17-9. As shown in the table, three roadway segments would require improvements to meet the LOS standards under future no-project conditions: SR 12 west of Terminus (2012 and 2030 conditions), Jersey Island Road north of Cypress Road (2030 conditions), and Cypress Road west of Jersey Island Road (2030 conditions). In other words, even if the Delta Wetlands project were not implemented, these three roadway segments would still exceed the LOS standard.

Future Level of Service with Implementation of Planned (Unfunded) Roadway Improvements

As described above under "Planned Roadway Improvements" in the "Affected Environment" subsection, a number of studies have identified potential roadway improvements in the area. Some of these improvements would address the LOS deficiencies on SR 12 and Cypress Road shown in Table 3.17-9, but there is currently no funding commitment to build those roadway improvements. The proposed roadway improvements include:

- SR 12 west of Terminus: a passing lane should be added (2012), and the section should eventually be widened to four lanes (2030); and
- Cypress Road west of Jersey Island Road: the section should be widened to four lanes (2030).

Table 3.17-9
Projected Future No-Project LOS Conditions, Operational Phase

Roadway Segment Location	LOS Standard	2012		2030	
		Peak Hour Volume	LOS	Peak-Hour Volume	LOS
SR 4 south of Cypress Road	E	1,240	E	1,500	E
SR 4 south of Delta Road	E	1,400	E	1,320	E
SR 4 east of Tracy Boulevard	D	830	D	1,000	D
SR 12 west of Terminus	D	1,930	**E**	2,300	**E**
Bacon Island Road at the Bacon Island Road Bridge	C	90	A	120	A
Lower Jones Road north of Cook Road	C	40	A	60	A
Jersey Island Road north of Cypress Road	D	70	A	1,320	**E**
Cypress Road west of Jersey Island Road	D	750	C	3,430	**F**
Byron Highway south of Delta Road	High C	140	A	200	A
Delta Road east of Byron Highway	High C	50	A	80	A

Notes: SR = State Route; LOS = level of service; **bold** text indicates an exceedance of a LOS standard.

Sources: ICF 2010:4.10-29 and AECOM 2014

Table 3.17-10 shows the resulting LOS on these two roadway facilities assuming that the proposed roadway improvements are funded and implemented. As shown in the table, implementation of these proposed (but presently unfunded) roadway improvements would ensure that both SR 12 and Cypress Road would meet the LOS standards under 2012 and 2030 future no-project conditions.

Table 3.17-10 Projected Future No-Project LOS Conditions (Operational Phase) with Implementation of Planned (Unfunded) Roadway Improvements					
		2012		2030	
Roadway Segment Location	LOS Standard	Peak-Hour Volume	LOS	Peak-Hour Volume	LOS
SR 12 west of Terminus	D	1,930	C[1]	2,300	B[3]
Cypress Road west of Jersey Island Road	D	N/A[2]	N/A[2]	3,430	C[3]

Notes: SR = State Route; LOS = level of service; N/A = not available

[1] With passing lane added.

[2] Not available—no additional roadway improvement needed.

[3] With widening to four lanes.

Source: ICF 2010:4.10-30; adapted by AECOM in 2013

3.17.5 Environmental Consequences and Mitigation Measures

Effects Analysis

Future With-Project Conditions

Roadway Traffic

Effects related to congestion, circulation, access, and safety are analyzed and discussed below. Effects related to congestion, circulation, and access are analyzed as they are the major indicators of traffic conditions in a given area. Safety effects also are analyzed because of the potentially dangerous conditions associated with the addition of large construction or agricultural vehicles to semi-rural roadways. It should be noted that Alternatives 1, 2 (Proposed Action), and 3 would involve the sale of water stored on the Reservoir Islands. If water sales do occur, water would be transferred through existing pipelines and aqueducts to the purchaser. Therefore, implementation of Alternatives 1, 2, or 3 would not generate traffic associated with transport of water.

The assessment of the effects of the proposed development on the roadway operation system was conducted by adding the estimated project-generated trips onto the projected future no-project traffic conditions for the expected buildout year (2012) and the long-range planning horizon (2030).

Two periods of effect are assessed in this section: construction, which is temporary, and operation, which is long-term. Construction effects are analyzed qualitatively. Operation effects are analyzed through comparison of LOS for the Proposed Action each project alternative to future no-project conditions.

Construction Effects

Construction effects consist of effects related to traffic congestion, safety, circulation, and access occurring during the estimated 1.5-year project construction period (the construction period is assumed to be approximately 2.5 years long under Alternative 3 on Bouldin Island). The construction period may be longer than 1.5 calendar years, but the shorter period is assumed in the traffic analysis to estimate a worst-case traffic scenario in which all construction traffic would occur within a short time frame. Although existing farming activities gradually would be phased out over the period of construction, under the worst-case scenario, it is assumed that some of the existing farming activities still would be conducted throughout the construction period. Because construction-related effects would occur only during the period of construction, they are considered temporary and short term.

Operation Effects

Operation-related effects consist of effects on traffic congestion, safety, and circulation during the life of the project. Congestion was analyzed through comparison of future LOS with the project operation and future no-project LOS. Operation-related safety and circulation effects were analyzed qualitatively.

Table 3.17-11 summarizes the expected traffic volumes and resulting LOS projected on the studied roadway sections under future conditions in 2012; Table 3.17-12 presents the same information for 2030. Alternatives 1 and 2 would have the same effects on traffic and transportation, and therefore these two alternatives have been combined in the LOS tables.

As shown in Tables 3.17-11 and 3.17-12, the three roadway segments that exceeded the LOS standards under the future no-project conditions (SR 12, Jersey Island, and Cypress Road) also would be deficient under all project alternatives.

Table 3.17-11
Projected Future LOS for Operational Phase (2012)

		No-Action Alternative		Alternative 1 or 2		Alternative 3	
Roadway Segment	LOS Standard	Peak-Hour Volume	LOS	Peak-Hour Volume	LOS	Peak-Hour Volume	LOS
SR 4 south of Cypress Road	E	1,267	E	1,244	E	1,245	E
SR 4 south of Delta Road	E	1,427	E	1,404	E	1,405	E
SR 4 east of Tracy Boulevard	D	857	D	834	D	835	D
SR 12 west of Terminus	D	1,940	**E**	1,931	**E**	1,932	**E**
Bacon Island Road at the Bacon Island Road Bridge	C	113	A	93	A	94	A
Lower Jones Road north of Cook Road	C	40	A	40	A	40	A
Jersey Island Road north of Cypress Road	D	89	A	73	A	74	A
Cypress Road west of Jersey Island Road	D	769	C	753	C	754	C
Byron Highway south of Delta Road	High C	146	A	141	A	141	A
Delta Road east of Byron Highway	High C	56	A	51	A	51	A

Notes: SR = State Route; LOS = level of service; **bold** text indicates an exceedance of a LOS standard

Sources: ICF 2010:4.10-31 and AECOM 2014

Tables 3.17-13 and 3.17-14 show the LOS on the two deficient roadway segments after the implementation of the improvements needed to address the future no-project deficiencies (described under future no-project conditions), respectively for 2012 and for 2030. As shown in these tables, the roadway improvements proposed under the future no-project conditions would ensure that both the SR 12 and Cypress Road roadway sections meet the LOS standards under all 2012 and 2030 project alternative. However, as previously noted, there is no funding commitment at this stage to build these planned improvements.

Table 3.17-12 Projected Future LOS for Operational Phase (2030)							
		No-Action Alternative		Alternative 1 or 2		Alternative 3	
Roadway Segment	LOS Standard	Peak-Hour Volume	LOS	Peak-Hour Volume	LOS	Peak-Hour Volume	LOS
SR 4 south of Cypress Road	E	1,527	E	1,504	E	1,505	E
SR 4 south of Delta Road	E	1,347	E	1,324	E	1,325	E
SR 4 east of Tracy Boulevard	D	1,027	D	1,004	D	1,005	D
SR 12 west of Terminus	D	2,310	**E**	2,301	**E**	2,302	**E**
Bacon Island Road at the Bacon Island Road Bridge	C	143	A	123	A	124	A
Lower Jones Road north of Cook Road	C	60	A	60	A	60	A
Jersey Island Road north of Cypress Road	D	1,339	**E**	1,323	**E**	1,324	**E**
Cypress Road west of Jersey Island Road	D	3,449	**F**	3,433	**F**	3,434	**F**
Byron Highway south of Delta Road	High C	206	A	201	A	201	A
Delta Road east of Byron Highway	High C	86	A	81	A	81	A

Notes: SR = State Route; LOS = level of service; text in **bold** indicates an exceedance of a LOS standard

Sources: ICF 2010:4.10-32 and AECOM 2014

Table 3.17-13 Projected Future LOS Operational Phase with Implementation of Planned Unfunded Roadway Improvements (2012)							
		No-Action Alternative		Alternative 1 or 2		Alternative 3	
Roadway Segments with Deficiencies	LOS Standard	Peak-Hour Volume	LOS	Peak-Hour Volume	LOS	Peak-Hour Volume	LOS
SR 12 west of Terminus	D	1,940	C[1]	1,939	C[1]	1,939	C[1]
Cypress Road west of Jersey Island Road	D	N/A[2]	N/A[2]	N/A[2]	N/A[2]	N/A[2]	N/A[2]

Notes: SR = State Route; LOS = level of service

[1] With passing lane added.

[2] Not available—No additional roadway improvement needed.

Sources: ICF 2010: 4.10-32 and AECOM 2014

Waterway Traffic and Safety

The number of boat trips expected to occur per day during construction and operation of the project is shown in Table 3.17-4 (Alternatives 1, 2, and 3) and Table 3.17-7 (No-Action Alternative). The analysis addresses project effects on waterway traffic, safety, and navigability in Delta waterways during construction and operation. Waterway traffic and safety could be affected by changes in the condition of channels adjacent to the project islands.

Table 3.17-14 Projected Future LOS Operational Phase with Planned Unfunded Roadway Improvements (2030)							
		No-Action Alternative		Alternative 1 or 2		Alternative 3	
Roadway Segment	LOS Standard	Peak-Hour Volume	LOS	Peak-Hour Volume	LOS	Peak Hour Volume	LOS
SR 12 west of Terminus	D	2,310	B[1]	2,300	B[1]	2,300	B[1]
Cypress Road west of Jersey Island Road	D	3,449	C[1]	3,431	C[1]	3,432	C[1]

Notes: SR = State Route; LOS = level of service

[1] With widening to four lanes.

Sources: ICF 2010:4.10-33 and AECOM 2014

No-Action Alternative

EFFECT TRA-1 **Increased Traffic Volumes and Roadway Level of Service During Construction Activities.** *Under the No-Action Alternative, construction activities would not occur. Thus, there would be no increase in roadway traffic and no changes in the LOS. No effect would occur.*

Under the No-Action Alternative, construction activities would not occur. Thus, there would be no increase in roadway traffic and no changes in the LOS. **No effect** would occur.

EFFECT TRA-2 **Increased Traffic Volumes and Roadway Level of Service During Operational Activities.** *Operational traffic under the No-Action Alternative would contribute to a decrease in LOS on two roadway segments; however, this decrease in LOS would occur with or without project operations. Roadway improvements to correct the LOS are already planned under future no-project conditions, and these improvements would also address the traffic contribution under the No-Action Alternative. This effect is less than significant.*

Under the No-Action Alternative (see Table 3.17-8), approximately half of the number of vehicle trips would be generated as compared to Alternatives 1, 2, or 3 (see Table 3.17-6). However, because project implementation would add so few vehicles to the roadway network, the roadway LOS would be similar under the No-Action Alternative as it would if Alternatives 1, 2, or 3 were implemented. Even without project implementation, SR 12 west of terminus is operating at a deficient LOS now (Table 3.17-2), and both Cypress Road west of Jersey Island Road and Jersey Island Road north of Cypress Road would operate at a deficient LOS in the future (Table 3.17-9). Roadway improvements to correct the LOS are already planned under future no-project conditions (Table 3.17-10, and these improvements would also address the traffic contribution under the No-Action Alternative. This effect is **less than significant**.

EFFECT TRA-3 **Potential for Traffic Safety Conflicts on Delta Roadways During Construction Activities.** *Under the No-Action Alternative, construction activities would not occur. Thus, there would be no traffic safety conflicts on Delta roadways. No effect would occur.*

Under the No-Action Alternative, construction activities would not occur. Thus, there would be no traffic safety conflicts from construction activities on Delta roadways. **No effect** would occur.

EFFECT TRA-4 **Potential for Traffic Safety Conflicts on Delta Roadways During Operational Activities.** *The No-Action Alternative would contribute to traffic congestion and traffic safety conflicts on Delta roadways. This effect is significant.*

Farm vehicles and trucks transporting agricultural products occasionally cause traffic congestion on Delta roadways. The congestion is most apparent when these relatively slow-moving vehicles operate on high-speed roadways. The congestion is most frequent during harvest season, when the number of farm vehicles and transport trucks operating on public roads reaches a peak. Additionally, operation of these vehicles on public roadways can increase the frequency of traffic accidents. Because the No-Action Alternative would result in intensified agricultural operations, this alternative would contribute to traffic safety conflicts on Delta roadways. This effect is **significant**.

EFFECT TRA-5 **Change in Circulation on or Access to Delta Roadways During Construction Activities.** *Under the No-Action Alternative, construction activities would not occur. Thus, there would be no change in circulation or access to Delta roadways. No effect would occur.*

Under the No-Action Alternative, construction activities would not occur. Thus, there would be no change in circulation or access to Delta roadways. **No effect** would occur.

EFFECT TRA-6 ***Change in Circulation on or Access to Delta Roadways During Operational Activities.*** *Intensified agricultural activities under the No-Action Alternative would not change the roadway circulation patterns or change the access to Delta roadways. No effect would occur.*

Implementation of the No-Action Alternative would not include development of new facilities that could generate increased traffic. Intensified agricultural activities under the No-Action Alternative would not change the roadway circulation patterns or change the access to Delta roadways. **No effect** would occur.

EFFECT TRA-7 **Change to the Structural Integrity of County Roads.** *The No-Action Alternative would not result in substantial deterioration of the structural integrity of county roads. This effect is less than significant.*

As shown in Table 3.17-8, a maximum of 27 peak-hour trips on the Delta roadway network would occur under the No-Action Alternative. This is not enough traffic to result in a substantial deterioration of the structural integrity of county roads. This effect is **less than significant**.

EFFECT TRA-8 ***Fog Hazard for Roadway Traffic on SR 12.*** *Proposed water storage facilities would not be implemented under the No-Action Alternative; thus, there would be no potential for an increase in the fog hazard for roadway traffic along SR 12. No effect would occur.*

Because the proposed water storage facilities would not be implemented, there would be no potential for an increase in the fog hazard for roadway traffic along SR 12. **No effect** would occur.

EFFECT TRA-9 **Change in Ferry Traffic from Jersey Island to Webb Tract.** *Under the No-Action Alternative, the amount of traffic using the ferry from Jersey Island to Webb Tract would be substantially similar to existing conditions. This effect is less than significant.*

As shown in Table 3.17-8, a maximum of 27 peak-hour trips on the Delta roadway network would occur under the No-Action Alternative. The number of those vehicles using the ferry from Jersey Island to Webb Tract would not be substantially different from existing conditions. **No effect** would occur.

EFFECT TRA-10 **Increase in Boat Traffic and Congestion on Delta Waterways During Project Operation.** *No new recreational facilities would be constructed, and the minor project-related increase in boat traffic from the for-fee hunting program would not substantially increase congestion on Delta waterways. This effect is less than significant.*

Keeping the project islands in agricultural production under the No-Action Alternative would not substantially change the number of boating-related use-days, nor would it adversely affect boat congestion in Delta Channels. The number of recreation use-days for boating would increase somewhat because of boat-related transportation associated with the proposed for-fee hunting program (see Table 3.17-7). However, no additional boating facilities would be provided and no change to existing boating facilities would occur. The increased amount of recreational boating associated with the for-fee hunting program would not substantially increase congestion on Delta waterways. This effect is **less than significant.**

EFFECT TRA-11 **Change in Navigation Conditions on Delta Waterways Surrounding the Project Islands During Project Operation.** *Under the No-Action Alternative, no water storage or water intake and discharge facilities would be constructed. Thus, there would be no change in navigation conditions on Delta waterways. No effect would occur.*

Under the No-Action Alternative, no water storage or water intake and discharge facilities would be constructed. Thus, there would be no change in navigation conditions on Delta waterways. **No effect** would occur.

EFFECT TRA-12 **Creation of Safety Conflicts on Delta Waterways During Project Construction.** *Because the project would not be implemented, barges would not be used and there would be no associated creation of safety conflicts on Delta waterways. No effect would occur.*

Because the project would not be implemented, barges would not be used and there would be no associated creation of safety conflicts on Delta waterways. **No effect** would occur.

EFFECT TRA-13 **Increase in the Potential for Safety Problems on Waterways Surrounding the Project Islands.** *No new recreational facilities would be constructed, and the minor project-related increase in boat traffic from the for-fee hunting program would not substantially increase the potential for safety issues on Delta waterways. This effect is less than significant.*

The for-fee hunting program under the No-Action Alternative would result in a minor increase in boating recreation use-days (see Table 3.17-7). However, no additional boating facilities would be provided and no change to existing boating facilities would occur. The increased amount of recreational boating associated with the for-fee hunting program would not substantially increase the potential for safety issues on Delta waterways. This effect is **less than significant**.

Alternatives 1, 2 (Proposed Action), and 3

The effects analysis and mitigation measures for Alternatives 1 and 2 are the same; therefore, they are described together under this heading. Vehicle trips generated by the project under Alternative 3 are nearly identical as compared Alternatives 1 and 2, as shown in Table 3.17-3. As a result, the peak-hour traffic volumes are almost the same under Alternative 3 compared to Alternatives 1 and 2, as shown in Table 3.17-6. The resulting roadway LOS is exactly the same under Alternative 3 as it would be under Alternatives 1 and 2 (see Tables 3.17-11 and 3.17-12). Therefore, all three alternatives are discussed together under this heading.

EFFECT TRA-1 **Increased Traffic Volumes and Roadway Level of Service During Project Construction.** *Project-related construction activities would result in only a minor increase in roadway traffic and would have no effect on LOS. This effect is less than significant.*

Implementation of Alternatives 1, 2, or 3 would slightly increase peak-hour traffic volumes during project construction. Estimates of peak-hour traffic volumes generated during construction on each of the study area roadway segments are shown in Table 3.17-6. As shown therein, project-related construction activities would be temporary and short-term and would only result in an increase of 14 roadway trips, which would have no measurable effect on the LOS would not result in a substantial increase in traffic volumes on project area roadways. Therefore, this effect is **less than significant**.

Although no mitigation is required, implementing Mitigation Measure TRA-MM-1 would further reduce the level of this less-than-significant effect.

Mitigation Measure TRA-MM-1: Develop and Implement a Traffic Control Plan.

In keeping with standard practice, prior to beginning construction of any portion of the project, the project applicant's contractor will develop and implement a Traffic Control Plan (TCP). The TCP will be implemented throughout the course of project construction and will:

a. contain a plan for communicating construction plans with transit providers, emergency service providers, residences, and businesses located in the project vicinity;

b. identify roadway segments or intersections that are at or approaching an LOS that exceeds local standards and provide a means for construction-generated traffic to avoid these locations at the peak periods either by traveling different routes or by traveling at nonpeak times of day;

c. contain an access and circulation plan for use by emergency vehicles when lane closures and/or detours are in effect; if lane closures occur, provide advance notice to local fire and police departments to ensure that alternative evacuation and emergency routes are designed to maintain response times;

d. maintain access to existing residences in the area at all times;

e. provide adequate parking for construction trucks and equipment within the designated staging areas throughout the construction period;

f. provide adequate parking for construction workers within the designated staging areas;

g. require traffic controls on roadways adjacent to the project, including flag persons wearing bright orange or red vests and using a "Stop/Slow" paddle to control oncoming traffic; construction warning signs should be posted in accordance with local standards or those set forth in the Manual on Uniform Traffic Control Devices (Federal Highway Administration 2003) in advance of the construction area and at any intersection that provides access to the construction area;

h. require that written notification be provided to contractors regarding appropriate routes to and from the construction site and the weight and speed limits on local roads used to access the construction site; and

i. specify that a sign be posted at all active construction areas giving the name and telephone number or email address of the County staff person designated to receive complaints regarding construction traffic.

In addition, the following notes will be placed on all grading and building permits:

"No construction equipment will be transported or materials delivered between the hours of 6 a.m. and 9 a.m. or 4 p.m. and 6 p.m. Monday through Friday (traffic peak hours)."

"No local roads traversing a nearby neighborhood may be used as access to the project site by construction equipment or delivery equipment."

EFFECT TRA-2 **Decreased Traffic Volumes and Roadway Level of Service During Project Operation.** *Project-related operational traffic would decrease the traffic volumes compared to the No-Action Alternative and would decrease the delay along area roadways. However, three roadway segments would operate at an unacceptable LOS with or without project implementation. Since the delay decreases with project implementation, this effect is less than significant.*

There would be a slight decrease in traffic volume during the operational phase of Alternatives 1, 2, or 3, as shown in Tables 3.17-11(2012 conditions) and 3.17-12 (2030 conditions). This increase would have a negligible effect on traffic operations, and therefore, any associated effect would be **less than significant**.
However, as also shown in Tables 3.17-11 and 3.17-12, three roadway segments are projected to exceed the LOS standards with implementation of Alternatives 1, 2, or 3—SR 12 west of Terminus (2012 and 2030 conditions) and both Jersey Island Road north of Cypress Road and Cypress Road west of Jersey Island Road (2030). However, these two roadway segments would be deficient regardless of whether or not the project was implemented (i.e., future no-project conditions) as shown in Table 3.17-9. Furthermore, SR 12 west of Terminus is already operating at a deficient LOS under existing conditions (Table 3.17-2).

Roadway improvements proposed for future no-project conditions (Table 3.17-10) would be sufficient for both roadway sections to meet the LOS standards under both 2012 and 2030 project conditions (see Tables 3.17-13 and 3.17-14). However, as previously noted, there is no funding commitment at this stage to build those improvements. Nevertheless, since traffic volume associated with the buildout of Alternatives 1, 2, or 3 would be less than the No-Action Alternative, this effect is **less than significant**.

Mitigation Measure: No mitigation is required.

EFFECT TRA-3 **Potential for Traffic Safety Conflicts on Delta Roadways During Project Construction.** *Project-related construction activities would increase the number of large trucks on Delta roadways transporting materials and equipment to the project islands, resulting in potential traffic safety conflicts. This effect is potentially significant.*

Implementation of Alternatives 1, 2, or 3 would slightly increase traffic during project-related construction activities as shown in Table 3.17-3. A portion of this increase would consist of large trucks on Delta roadways that would be transporting materials and equipment to the project islands. Thus, there is a potential for temporary and short-term traffic safety conflicts on these roadways. Although agricultural activities would taper off from current levels throughout the construction period, under the worst-case scenario, it is assumed that all existing agricultural traffic levels would continue throughout the construction period. Therefore, because large construction vehicles would be added to traffic on Delta roadways and traffic safety conflicts could occur, this effect is **potentially significant**.

Mitigation Measure TRA-MM-2: Clearly Mark Intersections in the Project Vicinity that have Poor Visibility.

Before beginning construction at any of the project sites, visibility at intersections in the project vicinity will be assessed visually (as described below). If visibility is poor at any intersection, highly visible signs will be posted at all approaches to the intersection stating that construction activity is taking place and that drivers should be aware of construction vehicles traveling on roads in the area.

The project applicant's construction contractor and a representative of the San Joaquin County Department of Public Works will visually assess visibility at intersections along Bacon Island Road, SR 4 from I-5 to Bacon Island Road, SR 4 from Bacon Island Road to the San Joaquin County line, and SR 12 from I-5 to the west end of Bouldin Island.

The project applicant's construction contractor and a representative of the Contra Costa County Department of Public Works will visually assess visibility at intersections along SR 4 from the Contra Costa County line to SR 160, Jersey Island Road from Cypress Road to the Jersey-Bradford-Webb ferry, Cypress Road from SR 4 to Jersey Island Road, Delta Road from SR 4 to Holland Tract Road, Holland Tract Road from Delta Road to its end, Byron Highway from SR 4 to Delta Road, and SR 12 from the west end of Bouldin Island to SR 160.

Implementing Mitigation Measure TRA-MM-2 would reduce potential temporary and short-term traffic safety conflicts during project-related construction to a **less-than-significant** level because intersections in the project vicinity that have poor visibility will be enhanced with signage.

EFFECT TRA-4 — Potential for Traffic Safety Conflicts on Delta Roadways During Project Operation. *Project implementation would result in a reduction in agricultural vehicle traffic on Delta roadways during project operation, and project operational activities would not generate additional large-truck traffic. This effect is beneficial and less than significant.*

Farm vehicles and trucks transporting agricultural products occasionally cause traffic congestion on Delta roadways. The congestion is most apparent when these relatively slow-moving vehicles operate on high-speed roadways. The congestion is most frequent during harvest season, when the number of farm vehicles and transport trucks operating on public roads reaches a peak. Additionally, operation of these vehicles on public roadways can increase the frequency of traffic accidents. Because implementation of Alternatives 1, 2, or 3 would result in a reduction in agricultural vehicle traffic on Delta roadways during project operation, and because project operation would not generate additional large-truck traffic this effect is **beneficial** and **less than significant**.

Mitigation Measure: No mitigation is required.

EFFECT TRA-5 — Change in Circulation on or Access to Delta Roadways During Project Construction. *Because most project-related construction activities would take place on the interior side of levees, substantial changes in circulation or access to Delta roadways would not occur. This effect is less than significant.*

During project-related construction activities under Alternatives 1, 2, or 3, circulation on and access to Delta roadways could be temporary adversely affected by road closures or detours. However, since most of the construction activity would take place on the interior side of the levees, implementation of Alternatives 1, 2, or 3 would not result in substantial changes in circulation or access to Delta Roadways. Therefore, this effect is **less than significant**.

Mitigation Measure: No mitigation is required.

EFFECT TRA-6 — Change in Circulation on or Access to Delta Roadways During Project Operation. *Project operation would not entail any alterations to the existing roadway network, and the additional project-generated operational traffic would not change roadway circulation patterns. This effect is less than significant.*

During the project's operational phase, roadway circulation and access could be adversely affected by increased peak-hour traffic volumes, as discussed above under Effect TRA-2. However, implementation of Alternatives 1, 2, or 3 would not involve any alterations to the existing roadway network in the project vicinity and therefore would not affect roadway access, and the addition of 50 additional peak-hour trips would not change circulation patterns measurably on Delta roadways. Therefore, this effect is **less than significant**.

Mitigation Measure: No mitigation is required.

EFFECT TRA-7 **Change to the Structural Integrity of County Roads.** *Project implementation would result in substantial additional deterioration of the structural integrity of county roads, and project-related levee improvements would also improve the conditions of several project area roadways. This effect is less than significant.*

Implementation of Alternatives 1 or 2 would result in levees surrounding reservoir islands being raised and widened. Erosion-resistant facing would be placed on the interior slopes of the levees. These levee improvement activities would increase the structural integrity of Bacon Island Road on the eastern perimeter levee of Bacon Island. Because subsidence rates on habitat islands would decrease under Alternatives 1 or 2, the stability of levees surrounding Bouldin Island and Holland Tract would increase. The project would undertake levee rehabilitation on the Habitat Islands as needed consistent with the state standards as described in California Department of Water Resources Bulletin 192-82 (California Department of Water Resources 1982), which would strengthen the levees. Holland Tract Road would benefit from the increased levee stability and the probable reduction of road maintenance activities.

The maximum amount of additional vehicles that would be generated from project implementation would be approximately 159 (under Alternative 3, see Table 3.17-3). It should be noted that under the No-Action Alternative, even though construction-related traffic effects would not occur, operational traffic associated with agricultural uses would result in similar operational effects as those attributed to the project. Therefore, the rate of county road deterioration would not be anticipated to be substantially more with project implementation compared to the No-Action Alternative. Furthermore, the project would comply with San Joaquin County and Contra Costa County requirements to obtain an encroachment permit to do work in the county's rights-of-way, as appropriate, to minimize project-generated road deterioration. The project would also be required to obtain and comply with county transportation permit requirements for the use of oversized and/or overweight vehicles. Therefore, this effect is **less than significant** under Alternatives 1 and 2.

If Alternative 3 were implemented, Wilkerson Dam would have to be constructed south of SR 12 to retain water on the island and protect the existing highway. Because the design of Wilkerson Dam would minimize seepage, settlement, and erosion, adverse effects on the structural integrity of SR 12 caused by levee failure, flooding would have a low probability of occurring (see 2001 FEIS, Appendix E1, "Design and Construction of Wilkerson Dam South of SR 12 on Bouldin Island" herein incorporated by reference).

Groundwater levels beneath the SR 12 roadbed and in the seepage drainage ditches on both sides of the highway are controlled by farming practices. Water levels in the ditches can vary by as much as 6 feet over the course of a year because of cyclical flooding and irrigation. Water from the existing drainage ditches would be pumped to stabilize groundwater levels in the ditches and beneath the SR 12 roadbed. To ensure that the project does not cause a substantial increase in water levels, the project applicant would coordinate with Caltrans to establish a seepage performance level for Wilkerson Dam as discussed above under the "Environmental Commitments" subsection. Groundwater levels along SR 12 would be regulated by pumps that maintain water levels in the drainage ditch along SR 12. The pumps would be set to activate automatically if ditch water levels exceed the performance standard established by Caltrans and the project applicant. Additionally, the project applicant, in coordination with Caltrans, would review the regrading design for the North Bouldin Habitat Area verify that the probability of adverse flooding effects along the north side of SR 12 would be negligible. Therefore, this effect is **less than significant** under Alternative 3.

Mitigation Measure: No mitigation is required.

EFFECT TRA-8 **Fog Hazard for Roadway Traffic on SR 12.** *Water storage on the project islands could substantially increase the fog hazard for roadway traffic along SR 12. This effect is less-than-significant for Alternatives 1 and 2 and potentially significant for Alternative 3.*

Low-lying winter fog is an existing traffic hazard on SR 12 and in the project area. Alternatives 1 and 2 would not create enough additional water storage to increase the fog hazard. Therefore, for Alternatives 1 or 2, the effect is **less than significant**.

However, implementing Alternative 3 would increase the amount of water surface area adjacent to SR 12, and the amount of fog produced on Bouldin Island could increase and thereby have an adverse effect on traffic conditions on SR 12. Constructing reservoirs on the project islands would not substantially increase regional fog hazards in the Delta but may create patches of fog on each island. Because SR 12 is a regional transportation route, increasing fog on Bouldin Island may increase traffic hazards. The reservoir would be constructed 240-370 feet from the existing highway right-of-way (ICF 2001:3E-15), and the highway is currently raised +4 feet above adjacent fields, which may alleviate some fog hazard problems. Increased potential for fog to rise from the surface of reservoirs under Alternative 3 cannot be avoided, however, and is assumed to increase traffic hazards along SR 12. Therefore, this effect is **potentially significant** under Alternative 3.

Mitigation Measure: No mitigation is required for Alternatives 1 and 2.

Mitigation Measure: No feasible mitigation is available for Alternative 3.

There are no feasible mitigation measures available that would reduce the potential fog hazard under Alternative 3 to a less-than-significant level. Therefore, this effect is **potentially significant and unavoidable**.

EFFECT TRA-9 **Change in Ferry Traffic from Jersey Island to Webb Tract.** *Project implementation would decrease the amount of traffic using the ferry from Jersey Island to Webb Tract. This effect is less than significant.*

Implementation of Alternatives 1, 2, or 3 would result in cessation of farming operations on Webb Tract, and ferry traffic from Jersey Island to Webb tract would decline. An overall decline of ferry use from the existing average of 20 passengers per day would occur. Because all four project islands would be converted to water storage under Alternative 3, an even greater decline in ferry usage would occur. The current ferry schedule (5 days per week) would not change during project operation. The ferry would provide transportation for project workers year round. A projected net decline in ferry use during project operation would not result in a need for a new system or adversely affect operation and maintenance of the existing system. Reductions in traffic on the ferry, especially heavy grain truck traffic during harvest, could result in reduced operations and maintenance costs. Therefore, this effect is **less than significant**.

Mitigation Measure: No mitigation is required.

EFFECT TRA-10 **Increase in Boat Traffic and Congestion on Delta Waterways During Project Operation.** *No new project-related recreational facilities would be constructed, and therefore no increase in congestion from project-related boating would occur. There would be no effect.*

The only new operation-related boat trips that would be generated as part of the project would occur from facilities maintenance. As shown in Table 3.17-4, total daily operation- and maintenance-related boat trips to the project islands under Alternatives 1, 2, and 3 would range from 1 to 3. Therefore, project operation would not result in an increase in congestion from boat traffic on Delta waterways. **No effect** would occur.

Mitigation Measure: No mitigation is required.

EFFECT TRA-11 **Change in Navigation Conditions on Delta Waterways Surrounding the Project Islands During Project Operation.** *All maintenance boat docks and gangways would be constructed according to recommended standards, water discharged from the project islands into adjacent waterways would not be of sufficient velocity to affect watercraft, and water storage on the project islands would not substantially increase fog conditions in adjacent waterways. This effect is less than significant.*

To minimize effects on navigability of Delta waterways, the project would design and construct the maintenance-related floating boat docks and gangways in accordance with the recommended standards of the 1991 California Department of Boating and Waterways' Layout, Design and Construction Handbook for Small Craft Boat Launching Facilities. In compliance with USACE recommendations for boat facilities, floating boat docks would not extend more than one-third the horizontal distance across the channel, and a navigation channel of not less than 100 feet would be maintained at all times.

Water discharged from the reservoir islands into adjacent channels would not adversely affect navigation in those locations. Pumps would have an expansion chamber to slow the speed of water entering the Delta channels. The cross-sectional area at the point of discharge would be 30 square feet, resulting in an exit velocity of 3.33 feet per second. By the time water has moved a few feet past the pump exit, the velocity would slow to well below scour velocity, and with a pump spacing of 25 feet and a channel water depth of approximately 12 feet, the water velocity would slow to 0.33 foot per second by the time it reaches the surface. At this speed, water entering the Delta channels would not affect navigation of even small boats on the water surface.

As stated above under Effect TRA-8, water storage on the reservoir islands could increase fog on the project islands during the winter months but would not substantially affect existing fog conditions in the adjacent channel waters or in other parts of the Delta (ICF 2010:4.10-17 and -39). Therefore, increased fog on the reservoir islands would not affect boater navigation in adjacent channels.

For the reasons stated above, project operation under Alternatives 1, 2, or 3 would have a **less-than-significant** effect on navigation conditions on delta waterways surrounding the project islands during project operation.

Mitigation Measure: No mitigation is required.

EFFECT TRA-12 **Creation of Safety Conflicts on Delta Waterways During Project Construction.** *Barges used to transport rock and moored at the project islands would partially obstruct Delta channels and would contribute to navigation and safety issues on Delta waterways during construction. This effect is potentially significant.*

During project-related construction activities under Alternatives 1, 2, or 3, large barges loaded with rock would be transported to the project islands. These barges most likely would be loaded directly from a quarry located on the water (e.g., the San Rafael rock quarry on San Pablo Bay). Additionally, a barge would be permanently moored at the project islands to assist with offloading and placement of rock. This barge would be equipped with a crane and would be moored using long pilings that are designed to be installed through openings in the base of the barge into the riverbed. Tugboats would transport barges loaded with rock to the permanently moored barge for offloading and placement. Because of their size, barges could obstruct more than one-third the width of a channel. Therefore, use of barges would contribute to potential temporary and short-term navigation and safety issues on Delta waterways during construction. This effect is **potentially significant**.

Mitigation Measure TRA-MM-3: Clearly Mark the Barge Moored at Project Islands and Notify the U.S. Coast Guard Prior to the Start of Construction Activities.

The project applicant's construction contractor will ensure that the barge moored at the project islands is well marked and lit in accordance with Title 14 of the California Code of Regulations, Section 7000 *et seq*. Additionally, the construction contractor will contact the U.S. Coast Guard 2 weeks before construction begins so that the Coast Guard can issue a notice to mariners alerting them to the presence of the barge and to construction activities occurring in the area. The contractor must inform the Coast Guard of the location and type of activity, whether night operations will be taking place, and whether there will be lights and buoys.

Implementing Mitigation Measure TRA-MM-3 would reduce effect TRA-9 under Alternatives 1, 2, or 3 to a **less-than-significant** level because the U.S. Coast Guard would be notified and barges moored at project islands would be clearly marked.

EFFECT TRA-13 Increase in the Potential for Safety Problems on Waterways Surrounding the Project Islands. *The project would not entail the construction of new recreational facilities; thus, there would be no substantial increase in the potential for boating accidents. This effect is less than significant.*

No new project-related recreational facilities would be constructed; therefore, a large number of additional boats, with associated safety conflicts, would not be introduced into Delta waterways as a result of the project. The only new boat trips that would be generated as part of the project would occur from construction and operation and maintenance of water storage and water intake and discharge facilities. As shown in Table 3.17-4, total daily construction-related boat trips to the project islands under Alternatives 1, 2, and 3 would range from 3 to 17. Total daily operation- and maintenance-related boat trips to the project islands under Alternatives 1, 2, and 3 would range from 1 to 3. Therefore, project implementation would not increase the potential for safety problems on waterways surrounding the project islands. This effect is **less than significant**.

Mitigation Measure: No mitigation is required.

Table 3.17-15
Comparison of Delta Wetlands Project 2001 FEIS and this SEIS Effects and Mitigation Measures for Traffic and Transportation

2001 FEIS Effects and Mitigation Measures	SEIS Effects and Mitigation Measures
Alternatives 1, 2 (Proposed Action) and 3	
Impact L-1: Increase in Traffic on Delta Roadways during Project Construction (LTS) **Mitigation:** No mitigation is required.	**Effect TRA-1:** Increased Traffic Volumes and Roadway Level of Service During Construction (LTS) Mitigation is not required, but the following would further reduce project effects: **Mitigation Measure TRA-MM-1:** Develop and Implement a Traffic Control Plan. The effect has not changed, but a mitigation measure has been added.
Impact L-2: Increase in Traffic on Delta Roadways during Project Operation (SU) **Mitigation RJ-1:** Reduce the Number of Outward Boat Slips Located at Recreation Facilities	**Effect TRA-2:** Increased Traffic Volumes and Roadway Level of Service During Operation (LTS) **Mitigation:** No mitigation is required. This effect is now considered less than significant; the 2001 FEIS considered roadway traffic and boat traffic together, and they have now been split into separate effects.

Table 3.17-15
Comparison of Delta Wetlands Project 2001 FEIS and this SEIS Effects and Mitigation Measures for Traffic and Transportation

2001 FEIS Effects and Mitigation Measures	SEIS Effects and Mitigation Measures
Impact L-3: Creation of Safety Conflicts on Delta Roadways during Project Construction (LTS-M) **Mitigation Measure L-1:** Clearly Mark Intersections with Poor Visibility in the DW Project Vicinity	**Effect TRA-3:** Potential for Traffic Safety Conflicts during Construction (LTS-M) **Mitigation Measure TRA-MM-2:** Clearly Mark Intersections with Poor Visibility in the Project Vicinity No change.
Impact L-4: Reduction in Safety Conflicts on Delta Roadways during Project Operation (B) **Mitigation:** No mitigation is required.	**Effect TRA-4:** Potential for Traffic Safety Conflicts during Operation (NI) **Mitigation:** No mitigation is required. No change.
Impact L-5: Change in Circulation on or Access to Delta Roadways during Project Construction (LTS) **Mitigation:** No mitigation is required.	**Effect TRA-5:** Change in Circulation on or Access to Delta Roadways during Project Construction (LTS) **Mitigation:** No mitigation is required. No change.
Impact L-6: Change in Circulation on Delta Roadways during DW Project Operation. (LTS) **Mitigation:** No mitigation is required.	**Effect TRA-6:** Change in Circulation on or Access to Delta Roadways during Project Operation (LTS) **Mitigation:** No mitigation is required. No change.
Impact E-1: Increase in the Structural Integrity of County Roads (LTS) **Mitigation:** No mitigation is required.	**Effect TRA-7:** Change to the Structural Integrity of County Roads (LTS) **Mitigation:** No mitigation is required. No change.
Impact E-15: Increase in the Fog Hazard on SR 12 (SU) **Mitigation:** No feasible mitigation is available.	**Effect TRA-8:** Fog Hazard for Roadway Traffic on SR 12 (Alternatives 1 and 2 = LTS; Alternative 3 = SU) **Mitigation:** No feasible mitigation is available under Alternative 3. No change.
Impact E-2: Reduction in Ferry Traffic from Jersey Island to Webb Tract (LTS) **Mitigation:** No mitigation is required.	**Effect TRA-9:** Change in Ferry Traffic from Jersey Island to Webb Tract (LTS) **Mitigation:** No mitigation is required. No change.
Impact L-7: Increase in Boat Traffic and Congestion on Delta Waterways during DW Project Operation (SU) **Mitigation RJ-1:** Reduce the Number of Outward Boat Slips Located at Recreation Facilities	**Effect TRA-10:** Increase in Boat Traffic and Congestion on Delta Waterways during Operation (NI) **Mitigation:** No mitigation is required. This effect and the mitigation measure have been revised because recreational facilities have been removed from the project.
Impact L-8: Change in Navigation Conditions on Delta Waterways Surrounding the DW Project Islands during Project Operation (LTS) **Mitigation:** No mitigation is required.	**Effect TRA-11:** Change in Navigation Conditions on Delta Waterways Surrounding the Project Islands during Operation (LTS) **Mitigation:** No mitigation is required.

Table 3.17-15 Comparison of Delta Wetlands Project 2001 FEIS and this SEIS Effects and Mitigation Measures for Traffic and Transportation	
2001 FEIS Effects and Mitigation Measures	SEIS Effects and Mitigation Measures
	No change.
Impact L-9: Creation of Safety Conflicts on Delta Waterways during Project Construction (LTS-M) **Mitigation Measure L-2:** Clearly Mark the Barge and Notify the U.S. Coast Guard of Construction Activities	**Effect TRA-12:** Creation of Safety Conflicts on Delta Waterways during Construction (LTS-M) **Mitigation Measure TRA-MM-3:** Clearly Mark the Barge Moored at Project Islands and Notify the U.S. Coast Guard Prior to the Start of Construction Activities No change.
Impact L-10: Increase in the Potential for Safety Problem on Waterways Surrounding the DW Project Islands (LTS-M) **Mitigation Measure L-3:** Clearly Post Waterway Intersections, Speed Zones, and Potential Hazards in the DW Project Vicinity	**Effect TRA-13:** Increase in the Potential for Safety Problems on Waterways Surrounding the Project Islands (LTS) **Mitigation:** No mitigation is required. This effect and the mitigation measures have been revised because recreational facilities have been removed from the project.

Notes: Shading denotes changes in the effect, significance conclusion, or mitigation measure from the 2001 FEIS; B = Beneficial; NI = No effect; LTS = Less than significant; LTS-M = Less than significant with mitigation; SU = Significant and unavoidable

Sources: ICF 2010:4.4-2 through 4.4-6 and 4.10-2 through 4.10-4 and AECOM 2014

3.17.6 Secondary and Cumulative Impacts

Secondary and cumulative effects on traffic and transportation from implementing the project were described in the 2001 FEIS (Chapter 3L) and the 2010 DEIR (Chapter 5). The 2001 FEIS and 2010 DEIR are herein incorporated by reference, and the effect conclusions and mitigation measures, along with any changes, are summarized briefly below and shown in Table 3.17-16.

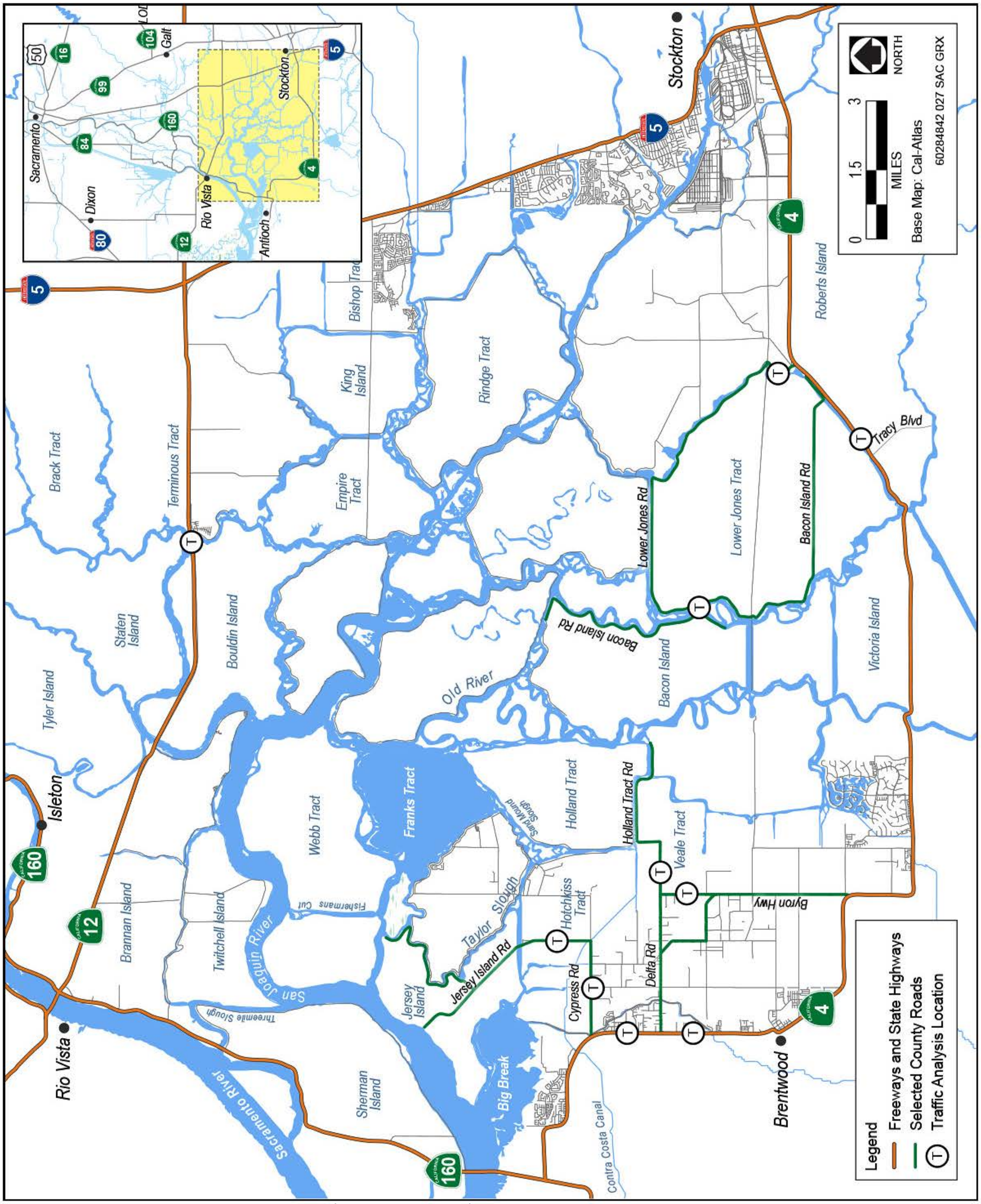
The analysis presented above is already cumulative in nature because it accounts for other projects that would occur independently of the project. For instance, the traffic growth projections and roadway operation analysis account for regional and local population and employment growth, anticipated future development projects, and planned roadway improvement projects. Because of this, the future no-project condition (2030) captures the effects of cumulative projects. Future condition scenarios (2030) with the project capture the effects of both cumulative projects and those of the Delta Wetlands project. Therefore, no additional analysis is required for secondary and cumulative effects.

Table 3.17-16
Comparison of Secondary and Cumulative Traffic and Transportation Effects between the 2001 FEIS and this SEIS

2001 FEIS Cumulative Effects and Mitigation Measures	SEIS Cumulative Effects and Mitigation Measures
Impact L-21: Increase in Traffic on Delta Roadways during Operation of Future Projects, Including the DW Project (NCC-M) **Mitigation Measure L-4:** Implement Caltrans' Route Concepts for SR 4 and SR 12 **Mitigation Measure RJ-1:** Reduce the Number of Outward Boat Slips Located at the Proposed Recreation Facilities	This is no longer considered a separate cumulative effect because future condition scenarios with the project, as analyzed in this section, capture the effects of both cumulative projects and those of the Delta Wetlands project. Please refer to Effect TRA-2: Increase in Traffic on Delta Roadways during Project Operation, for discussion of this effect. Furthermore, the project no longer includes the construction of new recreational facilities.
Impact L-22: Reduction in Safety Conflicts on Delta Roadways during Operation of Future Projects, Including the DW Project (B) **Mitigation:** No mitigation is required.	This is no longer considered a cumulative effect because future condition scenarios with the project, as analyzed in this section, capture the effects of both cumulative projects and those of the Delta Wetlands project. Please refer to Effect TRA-4: Potential for Traffic Safety Conflicts during Operation, for discussion of this effect.
Impact L-23: Cumulative Increase in Safety Problems on Delta Waterways (CCU) **Mitigation Measure L-5:** Develop and Enforce a Boater Safety Program for DW Private Boat Users **Mitigation Measure RJ-1:** Reduce the Number of Outward Boat Slips Located at the Proposed Recreation Facilities	This is no longer considered a cumulative effect because future condition scenarios with the project, as analyzed in this section, capture the effects of both cumulative projects and those of the Delta Wetlands project. Please refer to Effect TRA-10: Increase in Boat Traffic and Congestion on Delta Waterways during Operation, for discussion of this effect. Furthermore, the project no longer includes the construction of new recreational facilities.

Notes: Shading denotes changes in the effect, significance conclusion, or mitigation measure from the 2001 FEIS; CCU = Cumulatively considerable and unavoidable; NCC-M = Not cumulatively considerable with mitigation; B = Beneficial

Sources: ICF 2010:5-31 and 5-34 and AECOM 2014



Sources: Contra Costa County 2005, San Joaquin County 2012, and AECOM 2014

Exhibit 3.17-1 **Project Study Area Roadway Segments**

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3.18 UTILITIES AND SERVICE SYSTEMS

3.18.1 INTRODUCTION

This section describes recent changes to the existing environmental conditions and regulatory framework/applicable laws, regulations, plans, and policies of the project study area, summarizes the unchanged affected environment, and describes changed environmental effects related to utilities and service systems for the project. A review and update of the 1995 DEIR/EIS utilities assessment was incorporated in the 2001 FEIS. Chapter 3E in the 2001 FEIS provided detailed information regarding utilities and service systems associated with the project and in the Sacramento-San Joaquin Delta (Delta) in general. The utilities and service systems effects of the project were analyzed most recently in Section 4.4 and Chapter 5 of the 2010 DEIR, which also served as a basis for this analysis. The 1995 DEIR/EIS, 2001 FEIS, and 2010 DEIR are herein incorporated by reference.

The 2001 FEIS concluded that the project alternatives would affect utilities and service systems. Since that time, there have been minor changes in the "Affected Environment" subsection. As a result, certain effects related to natural gas lines, which previously were identified as significant, are now considered less than significant. Similarly, previously identified effects on gas pipeline Line 57A are no longer considered effects because Line 57A on Bacon Island has been abandoned and the pipeline has been removed. However, there have been no changes in the project that result in new significant adverse environmental effects or a substantial increase in the severity or intensity of previously identified significant effects on utilities and service systems.

Identification of the project's specific places of use does not affect utilities and service systems in any way that alters the conclusions of the 2001 FEIS. The project would not have any direct effects on utilities and service systems in the places of use; the effects on utilities and service systems if any, associated with the provision of project water to the place of use are addressed in the "Secondary and Cumulative Effects" subsection below and in Chapter 4, "Other Statutory Requirements."

SUMMARY OF CHANGES, NEW CIRCUMSTANCES, AND NEW INFORMATION

Substantial Changes in the Project

Since the 2001 FEIS was completed, the project applicant and Pacific Gas & Electric Company (PG&E) entered into an agreement in 2006 and amended in 2007 (Delta Wetlands Properties and Pacific Gas & Electric Company 2006), that resolved PG&E's protest to the project's water right applications. The agreement between the project applicant and PG&E provides for the following:

1. Removal of abandoned Line 57A on Bacon Island before water is diverted for storage onto Bacon Island.

2. Granting of an easement for new Line 57C to PG&E.

3. Reinforcement of the Line 57B levee crossings on Bacon Island before water is diverted for storage onto Bacon Island.

4. Relocation of the Line 57B cathodic protection station on Bacon Island, and provision of facilities for PG&E's annual inspection of pipelines 57B and 57C before water is diverted for storage onto Bacon Island.

5. Relocation of electrical transmission lines on Bacon Island before water is diverted for storage onto Bacon Island.

This agreement does not result in any changes in the severity or intensity of previously identified significant adverse effects on utilities and service systems.

The project no longer includes a proposal to construct new recreation facilities on the Reservoir or Habitat Islands; this change to the project results in a reduction and/or elimination of some the previously identified environmental effects.

New Circumstances

Since the 2001 FEIS were issued, PG&E has added a natural gas transmission pipeline, Line 57C, to the existing utility infrastructure on Bacon Island. Line 57C was installed in 2007 to improve the reliability of the Line 57 system connecting McDonald Island to major PG&E transmission facilities. The deactivated Line 57A across Bacon Island has been removed, and the line is now considered abandoned.

While there are new circumstances affecting utilities and service systems, these changes do not result in new significant adverse effects or increase in the severity or intensity of previously identified effects.

New Information

There is no new information of substantial importance that would result in a substantial increase in the severity or intensity of effects on utilities and service systems.

SUMMARY OF ENVIRONMENTAL COMMITMENTS

Environmental commitments are measures incorporated by the project applicant as part of the project, meaning they are proposed as elements of the Proposed Action and are therefore considered in conducting the environmental analysis for each resource area of this SEIS. The purpose of environmental commitments is to reflect and incorporate best practices into the project that avoid, minimize, reduce, or offset potential adverse environmental effects. A complete description of the environmental commitments that have been incorporated into the project since the 2001 FEIS is contained in Chapter 2, “Project Description and Alternatives,” of this SEIS.

As previously described, since the 2001 FEIS was completed, the project applicant and PG&E entered into an agreement that resolved PG&E’s protest to the project water right applications. This agreement has resulted in environmental commitments specific to utilities and service systems consisting of the following.

- If levee embankment construction for the project creates stress on the Line 57B pipeline that is substantially greater than the stress on the pipeline caused by the current levee, the project applicant will pay for the design and construction of a mutually acceptable engineering solution to reinforce, replace, or relocate the Line 57B eastern levee crossing on Bacon Island before water is diverted for storage onto Bacon Island.

- Line 57B, at the western Bacon Island levee embankment adjacent to Old River, will be replaced with a new pipeline installed by horizontal directional drilling (HDD) between Bacon Island and Palm Tract, unless the project applicant and PG&E mutually agree in writing to another construction approach. The design and length will be similar to the Line 57C HDD crossing, including setbacks to prevent pipe exposure in the event of a levee failure. Prior to construction of the new pipeline, the project applicant and PG&E will enter into a 50/50 cost sharing agreement for the design, permitting, material procurement, and construction of a new Line 57B HDD crossing beneath Old River, Bacon Island, and Palm Tract levees. The project’s construction activities that require the isolation and blowdown of Line 57B will occur only at a time when activities will not disrupt PG&E gas operations, typically between April 15 and November 15.

- The project applicant will pay to relocate the Line 57B cathodic protection station on Bacon Island, and will provide facilities for PG&E’s annual inspection of pipelines 57B and 57C before water is diverted for storage onto Bacon Island.

- The project applicant will compensate PG&E for any loss or damage to Line 57C caused by the conversion of Bacon Island into a water storage reservoir.

In addition to the above commitments stipulated in the settlement agreement, as part of the project's environmental commitments, during levee strengthening, project engineers will install equipment to monitor levee settlement and subsidence rates. After levee completion, the project applicant will conduct weekly inspections to check for potential problems at the gas pipeline crossings, including concerns about levee stability, settlement, and subsidence. If the weekly inspection indicates that settlement, erosion, or slumping at the gas pipelines has occurred, the project applicant will notify PG&E and will implement corrective measures to mitigate any decrease in levee stability near the gas pipelines.

3.18.2 AFFECTED ENVIRONMENT

Existing conditions related to utilities and service systems are, for the most part, as they were presented in the 2001 FEIS (Section 3E), and have not changed since they were presented in the 2010 DEIR (Section 4.4 and Chapter 5); therefore, those documents are herein incorporated by reference.

GAS FACILITIES AND TRANSMISSION PIPELINES

Bacon Island

PG&E presently owns two high-pressure gas transmission pipelines that cross Bacon Island: Lines 57B and 57C (see Exhibit 3.18-1). (PG&E has removed Line 57A within Bacon Island.) As part of PG&E's Line 57C Reliability Project, Line 57C, an approximately 6.4-mile-long high-pressure gas transmission pipeline, was constructed in 2007. Line 57C provides redundant pipeline capacity to ensure gas transmission between Brentwood and the McDonald Island Storage Field in the event of a failure of Line 57B in this region.

Line 57B

As discussed in the 2001 FEIS, Line 57B, constructed in 1974, serves as an input and output conduit for gas stored in the McDonald Island Storage Field. Line 57B connects PG&E's interstate and intrastate gas transmission and distribution system to the utility's underground natural gas storage facility under McDonald Island. The McDonald Island Storage Field has been used primarily to supply gas to the San Francisco Bay Area and Sacramento/Stockton market centers when other resources, such as gas production fields in Canada and the southwestern United States, are inadequate to meet instantaneous (i.e., peak) demands. The McDonald Island storage facility has supplied gas for up to one-third of PG&E's customers during peak demand periods.

Line 57B is 22 inches in diameter and is buried at a minimum of 3.5 feet below the ground surface as it crosses Bacon Island. Line 57B is designed to operate under temporarily flooded conditions or in saturated soils and, as constructed, is engineered and built to withstand more than the external pressure that would be applied by the load, or weight, of water under full reservoir conditions. Normal operation or integrity of the pipeline would not be impaired by the pressure of overlying water in a full reservoir. Line 57B is concrete-coated and rated for pressures up to 2,160 pounds per square inch (psi). It can convey approximately 1.25 billion cubic feet per day (Bcf/day).

Line 57C

Line 57C was installed in 2007 to expand and improve the reliability of the Line 57 system connecting McDonald Island to the major PG&E transmission facilities.

Line 57C originates at the McDonald Island Storage Field and crosses four islands—McDonald Island, Lower Jones Tract, Bacon Island, and Palm Tract—and four major waterways—Old River, Middle River, Latham Slough, and Empire Cut. Line 57C ties in with PG&E's existing Line 57 system on Palm Tract.

On Bacon Island, Line 57C is buried approximately 6 feet below farm fields, and is directionally drilled under the levees at a depth of approximately 100 feet and under the center canal at a depth of approximately 30 feet (Forkel pers. comm., 2008). Line 57C is 24 inches in diameter and concrete-coated. Line 57C is rated for pressures up to 2,160 psi.

Webb Tract

There is one active natural gas well on Webb Tract (Forkel pers. comm., 2008). There is one gas transmission pipeline from the island. There also are several previously plugged and abandoned gas extraction wells on Webb Tract.

Bouldin Island

One natural gas well exists on Bouldin Island, and it is not presently active (Forkel pers. comm., 2008). There are no gas transmission pipelines on the island.

Holland Tract

No natural gas wells or transmission pipelines exist on Holland Tract.

ELECTRICAL TRANSMISSION AND DISTRIBUTION LINES

No changes in electrical distribution lines have occurred since the 2001 FEIS was prepared. PG&E operates 12-kilovolt (kV) electrical distribution lines on all four Project Islands to serve residences and farm operations. These lines typically run on wooden utility poles.

Additionally, two major electrical transmission lines cross Hotchkiss Tract and Veale Tract to the west and southwest of Holland Tract: PG&E's 500-kV Table Mountain-to-Tesla line and Western Area Power Administration's 230-kV Intertie line.

WATER SUPPLY FACILITIES AND SEWAGE DISPOSAL SERVICE

No changes in water supply facilities or sewage disposal services have occurred since the 2001 FEIS was prepared. Existing water supply and sewage treatment facilities support farmsteads, rural residences, and seasonal barracks on Bacon Island; trailers, residences, and a clubhouse on Webb Tract; rural residences and farmsteads mostly north of State Route 12 on Bouldin Island; and rural residences, a trailer, and marinas on Holland Tract. Water supply for existing buildings and facilities on the project islands is provided by wells on the islands, water pumped from nearby channels, and bottled water service. Well water and pumped water are treated on the islands. Treatments include pretreatment reverse osmosis systems and filtering systems. All water services are privately managed; no public facilities are available on the project islands.

Private septic systems are the primary means of sewage disposal at existing buildings and facilities on the project islands. A lagoon treatment system on Holland Tract serves a marina. Waste is transported to a "lagoon" lined with material to prevent seepage into the ground and is treated through evaporation and aerobic decomposition.

SOLID WASTE SERVICE

There have been no changes to solid waste service since the 2001 FEIS was prepared. Solid waste collection and disposal service for the project islands is provided by private waste collection service(s) authorized to operate in

Contra Costa and San Joaquin Counties. The waste is collected and transported to the appropriate county landfills in compliance with county and state regulations governing solid waste disposal.

OTHER UTILITY FACILITIES ON ADJACENT DELTA ISLANDS

Pacific Gas & Electric Company and Western Area Power Administration Transmission Lines

Two major electrical transmission lines cross Hotchkiss Tract and Veale Tract to the west and southwest of Holland Tract: PG&E's 500-kV Table Mountain-to-Tesla line and the Western Area Power Administration's 230-kV Intertie line.

Mokelumne Aqueduct

The East Bay Municipal Utility District (EBMUD) owns and operates the Mokelumne Aqueduct, which crosses the Delta immediately south of the Santa Fe rail line (located in narrow linear causeway within Santa Fe Cut). The aqueduct, consisting of three above-ground steel and concrete pipelines, crosses Woodward Island south of Bacon Island, approximately 800 feet south of the rail line. Siphons connect the pipelines beneath Old River and Middle River west and east of Woodward Island. The aqueduct provides water to over 1 million people in the east San Francisco Bay Area.

3.18.3 REGULATORY FRAMEWORK/APPLICABLE LAWS, REGULATIONS, PLANS, AND POLICIES

Federal applicable laws and regulations are provided because they are required under NEPA. State applicable laws and regulations are provided for informational purposes and to assist with NEPA review. USACE has considered applicable state, regional, and local plans and ordinances as a part of the environmental review process for this SEIS, where applicable.

FEDERAL

Marine Plastic Pollution Research and Control Act

The Marine Plastic Pollution Research and Control Act of 1987 (33 United States Code 1901 et seq.) requires that all ports, terminals, and marinas provide adequate reception facilities for disposal of garbage from vessels with which they conduct commerce. This act sets performance standards to ensure that garbage is removed from the vessels and processed in accordance with U.S. Coast Guard and U.S. Department of Agriculture (USDA) regulations. However, the installation of equipment to handle garbage is not a requirement.

STATE

California Integrated Waste Management Act

To minimize the amount of solid waste that must be disposed of by transformation and land disposal, the California Legislature passed the California Integrated Waste Management Act (CIWMA) of 1989 (Assembly Bill 939), effective January 1990. According to the CIWMA, all cities and counties were required to divert 25% of all solid waste from landfill facilities by January 1, 1995, and 50% by January 1, 2000. Each city is required to develop solid waste plans demonstrating integration of the CIWMA plan with the county plan. The plans must promote (in order of priority) source reduction, recycling and composting, and environmentally safe transformation and land disposal.

California Public Utilities Commission Decision 95-08-038

The California Public Utilities Commission (CPUC) Decision 95-08-038 contains the rules for the planning and construction of new transmission facilities, distribution facilities, and substations. The decision requires permits for the construction of certain power line facilities or substations if the voltages would exceed 50 kV or if the substation would require the acquisition of land or an increase in voltage rating above 50 kV. Distribution lines and substations with voltages less than 50 kV do not need to comply with this decision; however, the utility must obtain any nondiscretionary local permits required for the construction and operation of these projects.

3.18.4 ANALYSIS METHODOLOGY

The analytical approach, effect mechanisms, and significance criteria remain as presented in the 2001 FEIS and are herein incorporated by reference. Potential effects of the Proposed Action and alternatives under consideration on utilities and service systems were evaluated based on how project operation would affect the ability of the service agencies and existing facilities to adequately serve the project islands. Effects of the project alternatives on gas and electrical lines and facilities on the project islands were determined through discussions with the affected utility agency and estimation of alterations to the existing infrastructure and any changes in existing operation of the facilities that would be needed during project operation.

SIGNIFICANCE CRITERIA

The basis for determining the significance of effects for this analysis is based on professional standards, project-specific criteria developed by the lead agency to address potential effects unique to the project's location and elements, and is informed by the criteria contained in the Environmental Checklist in Appendix G of the State CEQA Guidelines. These thresholds encompass the factors taken into account under NEPA to determine the significance of an action in terms of its context and the intensity of its effects. The Proposed Action or alternatives under consideration would have a significant, adverse effect on utilities and service systems if they would do any of the following:

- increase risk of structural failure of existing gas facilities and pipelines, electrical transmission or distribution lines, and water distribution facilities;
- result in a need for new systems, or substantial alterations to or increased maintenance of power or natural gas facilities, communication systems, water infrastructure, sewer lines, septic tanks, or solid waste services;
- result in a substantial disruption to existing natural gas service;
- increase risk of structural failure of gas facilities and pipelines;
- result in a need for substantial alterations to, or increased maintenance of, natural gas facilities; or
- result in increased demand for existing emergency services beyond their current capacity.

3.18.5 ENVIRONMENTAL CONSEQUENCES AND MITIGATION MEASURES

EFFECTS ANALYSIS

Effects on utilities and service systems resulting from project implementation were described in detail in the 2001 FEIS and are summarized briefly in Table 3.18-1. Where there have been no changes to the effect analysis or conclusions, the 2001 FEIS is herein incorporated by reference, and the effect conclusions and mitigation measures are briefly summarized.

No-Action Alternative

EFFECT UT-1 **Increase in the Risk to Gas Lines on Bacon Island.** *Although there would be no project-related levee improvements that would pose a risk to gas lines, continued subsidence on the project islands would result in increased maintenance of the gas lines. This effect is significant.*

Under the No-Action Alternative, the proposed levee improvements would not be implemented, and therefore a project-related risk related to structural failure of the existing gas lines would not occur. However, as discussed in the 2001 FEIS, continued subsidence resulting from increased agricultural uses under the No-Action Alternative would bring gas transmission lines on Bacon Island increasingly closer to the ground surface, requiring frequent restoration of the lines to new depths. Therefore, the No-Action Alternative would increase current maintenance requirements for the gas lines. The change in utility maintenance over time would be substantial and is a **significant** effect.

EFFECT UT-2 **Increase in PG&E Response Time to Repair a Gas Line Failure on Bacon Island.** *The project would not be implemented, and intensified agricultural operations would not cause a delay in PG&E repairs to gas lines. No effect would occur.*

Under the No-Action Alternative, the proposed water storage facilities would not be constructed. Intensified agricultural operations would not change the current PG&E response time to repair gas line failures. Thus, **no effect** would occur.

EFFECT UT-3 **Potential Interference with Pipeline Inspection Procedures.** *The project would not be implemented, and intensified agricultural operations would not interfere with pipeline inspection procedures. No effect would occur.*

Under the No-Action Alternative, the proposed water storage facilities would not be constructed. Intensified agricultural operations would not result in increased interference with PG&E's need to perform gas pipeline inspections. **No effect** would occur.

EFFECT UT-4 **Increase in Risk to Electrical Distribution Utilities on the Reservoir Islands.** *The project would not be implemented, and therefore overhead electrical lines on Webb Tract would not be inundated. However, continued subsidence on the project islands would subject electrical lines to increased risk of structural failure and increased maintenance. This effect is significant.*

Because the proposed water storage facilities would not be constructed, the existing PG&E overhead distribution lines on Webb Tract would not be inundated, and therefore raising or relocating the distribution lines to maintain electrical service between Bradford Island and Mandeville Island would not be required. However, as discussed in the 2001 FEIS, continued subsidence from increased agricultural uses under the No-Action Alternative would increase the risk of instability and failure of perimeter levees surrounding the project islands. Electrical distribution facilities located on perimeter levees would subsequently be subject to increased maintenance and risk of structural failure. Electrical facilities located on the interior of the project islands would also be disturbed by the effects of subsidence. This effect is **significant**.

EFFECT UT-5 **Possible Need to Increase Capacity of the Existing Electrical Distribution Lines on the Project Islands.** *The project would not be implemented, and intensified agricultural operations would not result in a need to increase the capacity of existing distribution lines. No effect would occur.*

Increasing the intensity of agricultural activities under the No-Action Alternative would not result in a need to increase the capacity of existing distribution lines, and therefore no additional electrical facilities would need to be installed. **No effect** would occur.

EFFECT UT-6 **Possible Need to Expand the Existing Electrical Distribution Lines on Webb Tract, Bouldin Island, and Holland Tract to Serve a Proposed Siphon Station and Recreational Facilities.** *The proposed siphon station would not be built and no new recreation facilities would be constructed; thus, there would be no need to expand the electrical distribution lines. No effect would occur.*

Because the project would not be implemented, PG&E would not need to provide electrical service to a siphon station on the northeast end of Webb Tract. No new recreation facilities along the perimeters of the project islands would be constructed, and therefore no new electrical service would be required. Intensified agricultural operations would not result in a need to expand the existing electrical distribution lines. Therefore, **no effect** would occur.

EFFECT UT-7 **Increase in Demand for Water Supply Services.** *No new project-related recreational facilities would be built, and thus there would be no project-related increase in the demand for water supply. Intensified agricultural activities would increase the need for irrigation water, but not measurably so at the scale of monthly water supply modeling. This effect is less than significant.*

No new project-related recreational facilities would be built, and thus there would be no related increase in the demand for water supply. Intensified agricultural activities would increase the need for irrigation water, but not measurably so at the scale of monthly water supply modeling. This effect is **less than significant**.

EFFECT UT-8 **Increase in Demand for Sewage Disposal Services.** *No new recreational facilities would be constructed, and intensified agricultural operations would not increase the demand for sewage disposal facilities. No effect would occur.*

No new project-related recreational facilities would be constructed, and thus there would not be an increased need for sewage disposal at new recreation facilities. The intensified agricultural operations and the for-fee hunting program that would occur under the No-Action Alternative would not require an increase in sewage disposal services. **No effect** would occur.

EFFECT UT-9 **Increase in Demand for Solid Waste Removal.** *The No-Action Alternative would not increase the demand for solid waste removal. No effect would occur.*

The project would not be implemented, and thus there would be no increase in demand for solid waste removal during construction of water and levee facilities. The intensified agricultural operations would not result in a need for solid waste removal associated with construction. **No effect** would occur.

EFFECT UT-10 **Effects to Infrastructure Facilities on Adjacent Islands.** *The proposed water storage facilities would not be constructed, and thus there would be no increased risk of levee failure and seepage to adjacent islands caused by water storage. No effect would occur.*

As discussed in the 2001 FEIS, under the No-Action Alternative, seepage to adjacent islands would be similar to existing seepage conditions because water would not be stored on the project islands in amounts above those needed for intensified agricultural use. Therefore, the No-Action Alternative would not affect infrastructure facilities on adjacent islands. **No effect** would occur.

Alternative 1 and Alternative 2 (Proposed Action)

The effects analysis and mitigation measures for Alternatives 1 and 2 are the same; therefore, they are described together under this heading.

EFFECT UT-1 **Increase in the Risk to Gas Lines Crossing Exterior Levees on Bacon Island Resulting from Levee Improvements.** *Flooding of the Reservoir Islands would affect monitoring and repairs of existing gas lines. However, the project applicant has entered environmental commitments that have been incorporated into the project to address monitoring and repairs of gas lines. This effect is less than significant.*

Consistent with the settlement agreement between PG&E and the project applicant (Delta Wetlands Properties and Pacific Gas & Electric Company 2007), Line 57A has been removed/abandoned and therefore is no longer a consideration for this analysis. Gas Line 57C was completed after the 2001 FEIS was prepared, and is therefore included in this effects analysis.

Flooding of the PG&E easement on Bacon Island under Alternatives 1and 2 would not increase the risk of structural failure of the operating gas pipelines or cause a physical change in PG&E's ability to supply gas to San Francisco Bay Area or Sacramento/Stockton market centers. However, flooding the island probably would change the manner in which PG&E monitors its pipelines and repairs leaks to the pipeline. Implementation of Alternative 1 or 2 could cause settlement issues or increased loads on the pipelines at the levee crossings and may require corrective measures during levee construction and settlement. The proposed levee buttressing could locally increase the rates of levee settlement or subsidence where the gas pipelines penetrate the Bacon Island exterior levees. Levee settlement or subsidence could increase the shear or bending loads on the pipelines, depending on the location of the pipeline with respect to the compressible levee foundation materials. The need for corrective measures and associated costs may increase during levee construction and settlement compared to existing pipeline maintenance requirements.

As outlined in the "Environmental Commitments" discussion in Subsection 3.18.1, the project will pay for the design and construction of a mutually acceptable engineering solution to reinforce, replace, or relocate the Line 57B eastern levee crossing on Bacon Island prior to water diversion for storage on the island. Similarly, the project will replace the Line 57B pipeline at the western levee embankment and the cost of the design, permitting, materials, and construction of the new replacement pipeline will be shared by PG&E and the project applicant. Any reinforced, replaced, or relocated pipelines would be engineered to withstand increased soil settlement pressures. Implementing these environmental commitments would prevent damage to the gas pipeline from increased bending or shear loads at levee crossings during levee construction and settlement. This effect is **less than significant**.

Although it is not required, implementing Mitigation Measure UT-MM-1 would further reduce the level of this less-than-significant effect.

Mitigation Measure UT-MM-1: Monitor Locations Where Gas Pipelines Cross Bacon Island Levees during and after Levee Construction.

During levee strengthening, the project applicant engineers will install equipment to monitor levee settlement and subsidence rates. After levee completion, the project applicant will conduct weekly inspections to check for potential problems at the gas pipeline crossings, including concerns about levee stability, settlement, and subsidence. If the weekly inspection indicates that settlement, erosion, or slumping at the gas pipelines has occurred, the project applicant will notify PG&E and will implement corrective measures to mitigate any decrease in levee stability near the gas lines.

EFFECT UT-2 **Increase in PG&E Response Time to Repair a Gas Line Failure on Bacon Island.** *Project implementation would delay PG&E repairs to gas lines. However, Line 57C provides gas system redundancy, and the likelihood of pipeline leak or rupture is the same regardless of whether or not the project is implemented. This effect is less than significant.*

Implementation of Alternatives 1 or 2 would delay and complicate repairs of PG&E pipeline facilities. Inundation of the island under project operations could interrupt service for a longer period than would occur under existing conditions; a severe leak or pipeline rupture would take longer to repair under flooded reservoir conditions than under the existing dry conditions. However, the risk of a pipeline leak or rupture on Bacon Island is very low, and such a leak or rupture would be equally likely under dry or wet conditions. This conclusion is based on the following considerations:

- Pipeline ruptures or leaks on Bacon Island would be caused by internal or external corrosion, levee settlement, or subsidence loads. In recent years, no pipeline ruptures in the Delta have been caused by these modes (U.S. Department of Transportation 2010). PG&E more often must respond to leaks caused by farm equipment; emergency repairs in the Delta caused by ground-disturbing equipment generally occur once or twice a year.

- Annual inspections to detect small leaks, monitor corrosion protection, identify potential levee subsidence or settlement problems, and prevent future pipeline ruptures or substantial pipeline leaks in those areas by prescribing immediate repair work, still would be conducted in accordance with Federal and state regulations.

- Based on modeling of project water storage operations (see Chapter 2, "Project Description and Alternatives"), it is estimated that Bacon Island would be at full storage in approximately 60% of the months simulated. Therefore, opportunities for repair and replacement of damaged pipeline segments under dry conditions would occur about 40% of the time.

Furthermore, it is unlikely that both Lines 57B and 57C would be damaged and need repair simultaneously. Line 57C was designed and constructed to provide redundancy in PG&E's Line 57 gas transmission system. Prior to the installation of Line 57C, Line 57B was the sole pipeline transporting gas between the McDonald Island underground storage field and PG&E's transmission system. Line 57C travels a different route from the McDonald Island storage field, thereby enhancing the reliability of gas supplies from that source.

If repairs are needed during flooded conditions on Bacon Island, implementing the project could extend the time required by PG&E to make necessary repairs. PG&E's emergency repair procedures under existing conditions and under project conditions are described in detail in the 2001 FEIS (Chapter 3E). However, PG&E's installation of Line 57C now provides gas system redundancy. For the reasons stated above, this effect is **less than significant**.

Mitigation Measure: No mitigation is required.

EFFECT UT-3 **Potential Interference with Pipeline Inspection Procedures.** *Project implementation could interfere with inspection of existing gas facilities. However, the project applicant has entered environmental commitments that have been incorporated into the project to address relocation and inspection of affected facilities. This effect is less than significant.*

As part of its pipeline operation, inspection, and maintenance procedures required by Federal and state regulations (49 Code of Federal Regulations 192 and CPUC General Order 112), PG&E conducts annual aerial and walking inspections along the pipeline route to check for small leaks, evidence of internal or external corrosion, or easement encroachment (e.g., new drainage ditches). Valves are also regularly monitored for pressure fluctuations that could be caused by leaks.

As part of the 2006 settlement agreement between the project applicant and PG&E, before water is diverted to storage on Bacon Island, the project applicant will provide mutually acceptable facilities on the island for PG&E's annual inspection of Lines 57B and 57C (Delta Wetlands Properties and Pacific Gas & Electric Company 2007). These facilities will be identified and located during the planning and design phase for the Bacon Island reservoir. In addition, as part of the settlement agreement the project applicant will provide a ramp and turnaround facilities to launch a boat for regular inspections; provide a suitable staging area for materials and equipment necessary for gas pipeline repairs; and install an elevated access roadway adjacent to Lines 57B and 57C (Delta Wetlands Properties and Pacific Gas & Electric Company 2007). These agreements will ensure that PG&E has access to the lines for annual inspections under wet as well as dry conditions.

PG&E also monitors the pipelines using internal inspection and cathodic protection testing. No valves are located on Bacon Island, and internal inspection ("pigging") could occur regardless of dry or wet conditions. Flooding the island would inundate cathodic protection test stations, rendering them unusable. The cathodic protection test stations would need to be relocated before flooding of Bacon Island. As stipulated in the 2006 settlement agreement, before water is diverted to storage on Bacon Island, PG&E will, at its expense, relocate the Line 57B cathodic protection test stations on Bacon Island to a mutually acceptable location (Delta Wetlands Properties and Pacific Gas & Electric Company 2007). In addition, if the test stations are to be located on Delta Wetlands' property, PG&E will consult with the project applicant on the design, siting and construction of the test stations, and the project applicant will provide PG&E access to the stations (Delta Wetlands Properties and Pacific Gas & Electric Company 2007). For the reasons stated above, this effect is **less than significant**.

Mitigation Measure: No mitigation is required.

EFFECT UT-4 Inundation of Electrical Distribution Utilities on the Reservoir Islands. *Project implementation would inundate overhead electrical lines on Bacon Island and Webb Tract. This effect is significant.*

Implementation of Alternatives 1 or 2 would inundate existing PG&E overhead distribution lines on Bacon Island and Webb Tract during water storage operations. Maintenance of electrical service between Bradford Island and Mandeville Island would require raising or relocating the distribution lines. This effect is **significant**.

Mitigation Measure UT-MM-2: Relocate Electrical Distribution Lines to the Perimeter Levee around Webb Tract.

The project, in coordination with PG&E, will permanently relocate the existing electrical distribution lines on Bacon Island and Webb Tract to the improved perimeter levees during project construction. The new or relocated distribution lines will be located along perimeter levees and will be installed overhead, similar to existing installations. Before temporarily or permanently modifying or relocating existing electrical lines, the project will conduct special-status plant surveys (Mitigation Measure BIO-MM-1) in areas that could be affected by the proposed modifications. If threatened or endangered plant species are found, the project will avoid disturbing those plants when making changes to existing electrical lines.

Implementing Mitigation Measure UT-MM-2 would reduce this effect to a **less-than-significant** level because the affected electrical lines would be relocated to assure continuation of service.

EFFECT UT-5 Possible Need to Increase Capacity of the Existing Electrical Distribution Lines on the Project Islands. *Increasing the capacity of existing distribution lines would not require new distribution easements or structures on the project islands. This effect is less than significant.*

Implementation of Alternatives 1 or 2 may require PG&E to provide electrical service for discharge pump stations and siphon stations on the project islands. If electrical service is required, PG&E would add capacity to the existing distribution lines. The proposed locations for some pump and siphon stations are adjacent to or within existing electrical line easements. Increasing the capacity of existing distribution lines would not require new distribution easements or structures on the islands. Therefore, this effect is **less than significant**.

Mitigation Measure: No mitigation is required.

EFFECT UT-6 **Possible Need to Expand the Existing Electrical Distribution Lines on Webb Tract, Bouldin Island, and Holland Tract to Serve a Proposed Siphon Station.** *New electrical service may be necessary, which would not easily be accommodated by existing electrical infrastructure. This effect is significant.*

Implementation of Alternatives 1 or 2 may require PG&E to provide electrical service to a siphon station on the northeast end of Webb Tract that would not easily be serviced by existing lines. Because service to this facility would require an extension of existing service lines, this effect is **significant**. (It should also be noted that any relocation or upgrade of electrical substation facilities [50,000 volts and above] may require formal approval from the CPUC and the CPUC may need to conduct additional environmental analyses.)

Mitigation Measure UT-MM-3: Extend Electrical Distribution Lines to Serve New Siphon and Pump Stations.

The project, in coordination with PG&E, will extend existing electrical distribution lines on the Reservoir Islands where needed to serve new siphon and pump stations. Before modifying existing electrical lines, the project will conduct special-status plant surveys (Mitigation Measure BIO-MM-1) in areas that could be affected by the proposed modifications. If threatened or endangered plant species are found, the project will avoid disturbing those plants when making changes to existing electrical lines.

Implementing Mitigation Measure UT-MM-3 would reduce this effect to a **less-than-significant** level because electrical distribution lines would be extended to serve the project as necessary.

EFFECT UT-7 **Increase in Demand for Water Supply Services.** *Project implementation would not increase the demand for water supply. No effect would occur.*

Implementation of Alternatives 1 and 2 would not increase the need for potable water on the project islands because no new recreation facilities would be constructed. Thus, there would be **no effect**.

Mitigation Measure: No mitigation is required.

EFFECT UT-8 **Increase in Demand for Sewage Disposal Services.** *Project implementation would not increase the demand for privately owned sewage disposal facilities. No effect would occur.*

Implementation of Alternative 1 or 2 would not result in an increased need for sewage disposal because no new recreation facilities would be constructed. Thus, there would be **no effect**.

Mitigation Measure: No mitigation is required.

EFFECT UT-9 **Increase in Demand for Solid Waste Removal.** *Project implementation would result in a minor increase in the demand for solid waste removal during construction activities. However, the project would implement recycling of waste as feasible, and the amount of solid waste removal would be very small and would not exceed the capacity of existing landfills. This effect is less than significant.*

Some solid waste would likely be generated during construction activities. The small amount of waste that may require landfill disposal is not expected to substantially decrease the existing lifespan of the landfills near the project area. Also, the project would investigate and implement, to the extent financially feasible, recycling opportunities. Therefore, this effect is **less than significant**.

Mitigation Measure: No mitigation is required.

EFFECT UT-10 **Effects to Infrastructure Facilities on Adjacent Islands.** *Increased risk of levee failure and seepage to adjacent islands caused by water storage on the Reservoir Islands could threaten the reliability of these facilities and increase maintenance and repair costs. However, the project includes improvements to levees around the project islands, which would increase their reliability. No effect would occur.*

Infrastructure on adjacent islands includes water conveyance facilities, underground gas fields and storage areas, and gas and electrical lines. Increased risk of levee failure and seepage to adjacent islands caused by proposed water storage on Bacon Island and Webb Tract under Alternatives 1 and 2 could threaten the reliability of these facilities and increase maintenance and repair costs. However, the project includes improvements to levees around the project islands, which would increase their reliability. The project also would mitigate any seepage problems beyond existing seepage levels by installing an interceptor well system around the project island levees. Project features would maintain potential effects related to levee stability and seepage at existing levels or better, and therefore implementing Alternatives 1 or 2 would not increase the risk to adjacent utilities. **No effect** would occur.

Mitigation Measure: No mitigation is required.

Alternative 3

EFFECT UT-1 **Increase in the Risk to Gas Lines Crossing Exterior Levees on Bacon Island Resulting from Levee Improvements.** *Flooding of the four project islands would affect monitoring and repairs of existing gas lines. However, the project applicant has entered environmental commitments that have been incorporated into the project to address monitoring and repairs of gas lines. This effect is less than significant.*

Under Alternative 3, water storage would also occur on Bouldin Island and Holland Tract, in addition to Bacon Island and Webb Tract. However, there are no natural gas transmission pipelines on either Bouldin Island or Holland Tract. Therefore, this effect would be the same as discussed above for Alternatives 1 and 2. Water storage on Bacon Island would not increase the risk of structural failure of the operating gas pipelines or cause a physical change in PG&E’s ability to supply gas to San Francisco Bay Area or Sacramento/Stockton market centers. However, implementation of Alternative 3 could cause settlement issues or increased loads on the pipelines at the levee crossings and may require corrective measures during levee construction and settlement.

Implementation of the environmental commitments discussed in Subsection 3.18.1 would prevent damage to the gas pipeline from increased bending or shear loads at levee crossings during levee construction and settlement. Therefore, this effect is **less than significant**.

Although it is not required, implementing Mitigation Measure UT-MM-1 would further reduce the level of this less-than-significant effect.

Mitigation Measure: Implement Mitigation Measure UT-MM-1 (Monitor Locations Where Gas Pipelines Cross Bacon Island Levees during and after Levee Construction).

EFFECT UT-2 **Increase in PG&E Response Time to Repair a Gas Line Failure on Bacon Island.** *Project implementation would delay PG&E repairs to gas lines. However, Line 57C provides gas system redundancy, and the likelihood of pipeline leak or rupture is the same regardless of whether or not the project is implemented. This effect is less than significant.*

As discussed above for Alternatives 1 and 2, implementing Alternative 3 would delay and complicate repairs of PG&E pipeline facilities. Inundation of the island under project operations could interrupt service for a longer period than would occur under existing conditions; a severe leak or pipeline rupture would take longer to repair under flooded reservoir conditions than under the existing dry conditions. However, the risk of a pipeline leak or rupture on Bacon Island is very low, and such a leak or rupture would be equally likely under dry or wet conditions.

If repairs are needed during flooded conditions on Bacon Island, implementing the project could extend the time required by PG&E to make necessary repairs. However, PG&E's installation of Line 57C now provides gas system redundancy. Therefore, this effect is **less than significant**.

Mitigation Measure: No mitigation is required.

EFFECT UT-3 **Potential Interference with Pipeline Inspection Procedures.** *Project implementation could interfere with inspection of existing gas facilities. However, the project applicant has entered environmental commitments that have been incorporated into the project to address relocation and inspection of affected facilities. This effect is less than significant.*

Under Alternative 3, water storage would also occur on Bouldin Island and Holland Tract, in addition to Bacon Island and Webb Tract. However, there are no natural gas transmission pipelines on either Bouldin Island or Holland Tract. Therefore, this effect is the same as discussed above for Alternatives 1 and 2.

Implementation of the environmental commitments discussed in Subsection 3.18.1 provides for relocation of facilities as necessary and includes provisions for inspection of facilities. Therefore, this effect is **less than significant**.

Mitigation Measure: No mitigation is required.

EFFECT UT-4 **Inundation of Electrical Distribution Utilities on the Project Islands.** *New electrical service may be necessary, which would not easily be accommodated by existing electrical infrastructure. This effect is significant.*

Implementation of Alternative 3 would cause inundation of existing PG&E overhead distribution lines on Webb Tract, Holland Tract, and Bouldin Island during water storage operations. As discussed above under Alternatives 1 and 2, to maintain existing service, the lines would need to be relocated. This effect is **significant**.

Mitigation Measure UT-MM-4: Relocate Electrical Distribution Lines to the Perimeter Levees around Webb and Holland Tracts and Bouldin Island.

The project applicant, in coordination with PG&E, will permanently relocate the electrical distribution lines on Webb and Holland Tracts and Bouldin Island to the improved perimeter levees during project construction. The new or relocated distribution lines would be located along perimeter levees and would be installed overhead, similar to existing installations. Before temporarily or permanently modifying or relocating existing electrical lines, the project will conduct special-status plant surveys (Mitigation Measure BIO-MM-1) in areas that could be affected by the proposed modifications. If threatened or endangered plant species are found, the project will avoid disturbing those plants when making changes to existing electrical lines.

Implementing Mitigation Measure UT-MM-4 would reduce this effect to a **less-than-significant** level because electrical distribution lines would be relocated as necessary to assure continued service.

EFFECT UT-5 **Possible Need to Increase Capacity of the Existing Electrical Distribution Lines on the Project Islands.** *Increasing the capacity of existing distribution lines would not require new distribution easements or structures on the project islands. This effect is less than significant.*

Implementation of Alternative 3 may require PG&E to provide electrical service for discharge pump stations and siphon stations on the project islands. PG&E would add capacity to the existing distribution lines, which would not require new easements or structures on the islands. Therefore, this effect is **less than significant**.

Mitigation Measure: No mitigation is required.

EFFECT UT-6 **Possible Need to Expand the Existing Electrical Distribution Lines on Webb Tract, Bouldin Island, and Holland Tract to Serve Proposed Siphon and Pump Stations.** *New electrical service may be necessary, which would not easily be accommodated by existing electrical infrastructure. This effect is significant.*

Implementation of Alternative 3 may require PG&E to provide electrical service to siphon stations and a pump station that would not be serviced easily by existing lines. The following proposed pump station and siphon stations shown in Exhibits 2-1 through 2-4 in Chapter 2, "Project Description and Alternatives" would not be located adjacent to existing electrical line corridors: a siphon station in the northeastern corner of Webb Tract, a discharge pump station and a siphon station on the eastern side of Bouldin Island, and a siphon station near the northernmost point of Holland Tract. Because electrical service to those facilities would require an extension of existing service lines, this effect is **significant**. (It should be noted that it also may be necessary to relocate or upgrade electrical lines and substation facilities to serve new project facilities; any relocation or upgrade of electrical substation facilities [50,000 volts and above] may require formal approval from the CPUC).

Mitigation Measure: Implement Mitigation Measure UT-MM-3 (Extend Electrical Distribution Lines to Serve New Siphon and Pump Stations).

Implementing Mitigation Measure UT-MM-3 would reduce this effect to a **less-than-significant** level because electrical distribution lines would be extended to project facilities as necessary.

EFFECT UT-7 **Increase in Demand for Water Supply Services.** *Project implementation would not increase the demand for water supply. No effect would occur.*

As discussed above for Alternatives 1 and 2, implementation of Alternative 3 would not increase the need for potable water on the project islands because no new recreation facilities would be constructed. Thus, there would be **no effect.**

Mitigation Measure: No mitigation is required.

EFFECT UT-8 **Increase in Demand for Sewage Disposal Services.** *Project implementation would not increase the demand for privately owned sewage disposal facilities. No effect would occur.*

As discussed above for Alternatives 1 and 2, implementation of Alternative 3 would not result in an increased need for sewage disposal because no new recreation facilities would be constructed. Thus, there would be **no effect**.

Mitigation Measure: No mitigation is required.

EFFECT UT-9 **Increase in Demand for Solid Waste Removal.** *Project implementation would result in a minor increase in the demand for solid waste removal during construction activities. However, the project would implement recycling of waste as feasible, and the amount of solid waste removal would be very small and would not exceed the capacity of existing landfills. This effect is less than significant.*

As discussed above for Alternatives 1 and 2, some waste would likely be generated during construction activities. Although the amount of solid waste generated under Alternative 3 would be somewhat larger than under Alternatives 1 and 2, the small amount of waste that may require landfill disposal is not expected to substantially decrease the existing lifespan of the landfills near the project area. Furthermore, the project would investigate and implement, to the extent financially feasible, recycling opportunities. Therefore, this effect is **less than significant**.

Mitigation Measure: No mitigation is required.

EFFECT UT-10 **Effects to Infrastructure Facilities on Adjacent Islands.** *Increased risk of levee failure and seepage to adjacent islands caused by water storage on the Reservoir Islands could threaten the reliability of these facilities and increase maintenance and repair costs. However, the project includes improvements to levees around the project islands, which would increase their reliability. No effect would occur.*

Under Alternative 3, potential seepage from project islands would be similar to that described above for Alternatives 1 and 2. However, the project includes improvements levees around the project islands, which would increase their reliability. The project also would mitigate any seepage problems beyond existing seepage levels by installing an interceptor well system around the project island levees. Project features would maintain potential effects related to levee stability and seepage at existing levels or better, and therefore implementing Alternative 3 would not increase the risk to adjacent utilities. **No effect** would occur.

Table 3.18-1
Comparison of Delta Wetlands Project 2001 FEIS to this SEIS Effects and Mitigation Measures for Utilities and Service Systems

2001 FEIS Effects and Mitigation Measures	SEIS Effects and Mitigation Measures
Alternatives 1 and 2 (Proposed Action)	
Impact E-3: Increase in the Risk to Gas Lines Crossing Exterior Levees on Bacon Island Resulting from Levee Improvements (LTS-M) **Mitigation Measure RE-1:** Monitor Locations Where Gas Pipelines Cross Bacon Island Levees during and after Levee Construction; and **Mitigation Measure RE-2:** Implement Corrective Measures to Reduce Risk of Pipeline Failure during Levee Construction	**Effect UT-1:** Increase in the Risk to Gas Lines Crossing Exterior Levees on Bacon Island Resulting from Levee Improvements (LTS) No mitigation is required, but implementing mitigation will further reduce the level of effect. **Mitigation Measure UT-MM-1:** Monitor Locations Where Gas Pipelines Cross Bacon Island Levees during and after Levee Construction Changes have been incorporated into the project to reduce the severity and intensity of this effect.
Impact E-4: Increase in PG&E Response Time to Repair a Gas Line Failure on Bacon Island (No significance conclusion) No significance conclusion was reached and no mitigation measures were identified, because this impact was determined to be economic in nature.	**Effect UT-2:** Increase in PG&E Response Time to Repair a Gas Line Failure on Bacon Island (LTS) **Mitigation:** No mitigation is required Since 2001, PG&E has installed Line 57C, which reduces the effect of the increased response time to a less-than-significant level.
Impact RE-1: Increase in the Risk to Line 57A from Island Inundation (LTS-M) **Mitigation Measure RE-3:** Securely Anchor Line 57A before Bacon Island Flooding	PG&E has removed the portion of Line 57A across Bacon Island. Therefore, this is no longer an effect and no mitigation is required.

Table 3.18-1
Comparison of Delta Wetlands Project 2001 FEIS to this SEIS Effects and Mitigation Measures for Utilities and Service Systems

2001 FEIS Effects and Mitigation Measures	SEIS Effects and Mitigation Measures
Impact RE-2: Potential Interference with Pipeline Inspection Procedures (LTS-M) **Mitigation Measure RE-4:** Provide Adequate Facilities on Bacon Island for Annual Pipeline Inspection; and **Mitigation Measure RE-5:** Relocate Cathodic Protection Test Stations before Bacon Island Flooding	**Effect UT-3:** Potential Interference with Pipeline Inspection Procedures (LTS) **Mitigation:** No mitigation is required Changes have been incorporated into the project to reduce the severity and intensity of this effect.
Impact E-5: Inundation of Electrical Distribution Utilities on the Reservoir Islands (LTS-M) **Mitigation Measure E-1:** Relocate Electrical Distribution Lines to the Perimeter Levee around Webb Tract	**Effect UT-4:** Inundation of Electrical Distribution Utilities on the Reservoir Islands (LTS-M) **Mitigation Measure UT-MM-2:** Relocate Electrical Distribution Lines to the Perimeter Levee around Webb Tract No change.
Impact E-6: Possible Need to Increase Capacity of the Existing Electrical Distribution Lines on the Project Islands (LTS) **Mitigation:** No mitigation is required.	**Effect UT-5:** Possible Need to Increase Capacity of the Existing Electrical Distribution Lines on the Project Islands (LTS) **Mitigation:** No mitigation is required. No change.
Impact E-7: Possible Need to Expand the Existing Electrical Distribution Lines on Webb Tract, Bouldin Island, and Holland Tract to Serve a Proposed Siphon Station and Recreation Facilities (LTS-M) **Mitigation Measure E-2:** Extend Electrical Distribution Lines to Serve New Siphon and Pump Stations and Recreation Facilities	**Effect UT-6:** Possible Need to Expand the Existing Electrical Distribution Lines on Webb Tract, Bouldin Island, and Holland Tract to Serve a Proposed Siphon Station (LTS-M) **Mitigation Measure UT-MM-3:** Extend Electrical Distribution Lines to Serve New Siphon and Pump Stations The effect analysis and mitigation measure have been updated to reflect the fact that no new recreation facilities would be constructed.
Impact E-10: Increase in Demand for Water Supply Services (LTS) Measures that would minimize the effects of this impact have been incorporated into the Project description. However, implementing the following would monitor the effectiveness of those measures: **Mitigation Measure E-7:** Obtain Appropriate Local and State Permits for Recreation Facility Services and Utilities	**Effect UT-7:** Increase in Demand for Water Supply Services (NI) **Mitigation:** No mitigation is required. The effect analysis and conclusion have been updated and the mitigation measure has been removed to reflect the fact that no new recreation facilities would be constructed.
Impact E-11: Increase in Demand for Sewage Disposal Services (LTS) Measures that would minimize the effects of this impact have been incorporated into the Project description. However, implementing the following would monitor the effectiveness of those measures: **Mitigation Measure E-7:** Obtain Appropriate Local and State Permits for Recreation Facility Services and Utilities	**Effect UT-8:** Increase in Demand for Sewage Disposal Services (NI) **Mitigation:** No mitigation is required. The effect analysis and conclusion have been updated and the mitigation measure has been removed to reflect the fact that no new recreation facilities would be constructed.
Impact E-12: Increase in Demand for Solid Waste Removal (LTS) Measures that would minimize the effects of this impact have been incorporated into the Project description. However, implementing the following would monitor the effectiveness of those measures: **Mitigation Measure E-7:** Obtain Appropriate Local and State Permits for Recreation Facility Services and	**Effect UT-9:** Increase in Demand for Solid Waste Removal (LTS) **Mitigation:** No mitigation is required. The effect analysis has been updated and the mitigation measure has been removed to reflect the fact that no new recreation facilities would be constructed.

Table 3.18-1 **Comparison of Delta Wetlands Project 2001 FEIS to this SEIS Effects and Mitigation Measures for Utilities and Service Systems**	
2001 FEIS Effects and Mitigation Measures	SEIS Effects and Mitigation Measures
Utilities	
Discussed in text but not numbered as an impact.	**Effect UT-10:** Effects to Infrastructure Facilities on Adjacent Islands (NI) **Mitigation:** No mitigation is required. No change.
Alternative 3	
Impact E-17: Increase in the Risk to Gas Lines Crossing Exterior Levees on Bacon Island Resulting from Levee Improvements (LTS-M) **Mitigation Measure RE-1:** Monitor Locations Where Gas Pipelines Cross Bacon Island Levees during and after Levee Construction **Mitigation Measure RE-2:** Implement Corrective Measures to Reduce Risk of Pipeline Failure during Levee Construction	**Effect UT-1:** Increase in the Risk to Gas Lines Crossing Exterior Levees on Bacon Island Resulting from Levee Improvements (LTS) No mitigation is required, but implementing mitigation will further reduce the level of effect. **Mitigation Measure UT-MM-1:** Monitor Locations Where Gas Pipelines Cross Bacon Island Levees during and after Levee Construction Changes have been incorporated into the project to reduce the severity and intensity of this effect.
Impact E-18: Increase in PG&E Response Time to Repair a Gas Line Failure on Bacon Island (No significance conclusion) No significance conclusion was reached and no mitigation measures were identified because this impact was determined to be economic in nature.	**Effect UT-2:** Increase in PG&E Response Time to Repair a Gas Line Failure on Bacon Island (LTS) **Mitigation:** No mitigation is required Since 2001, PG&E has installed Line 57C, which reduces the effect of the increased response time to a less-than-significant level.
Impact RE-3: Increase in the Risk of Line 57A from Island Inundation (LTS-M) **Mitigation Measure RE-3:** Securely Anchor Line 57A before Bacon Island Flooding	PG&E has removed the portion of Line 57A across Bacon Island. Therefore, this is no longer an effect and no mitigation is required.
Impact RE-4: Potential Interference with Pipeline Inspection Procedures (LTS-M) **Mitigation Measure RE-4:** Provide Adequate Facilities on Bacon Island for Annual Pipeline Inspection **Mitigation Measure RE-5:** Relocate Cathodic Protection Test Stations before Bacon Island Flooding	**Effect UT-3:** Potential Interference with Pipeline Inspection Procedures (LTS) **Mitigation:** No mitigation is required Changes have been incorporated into the project to reduce the severity and intensity of this effect.
Impact E-19: Inundation of Electrical Distribution Utilities on the Reservoir Islands (LTS-M) **Mitigation Measure E-9:** Relocate Electrical Distribution Lines to the Perimeter Levees around Webb and Holland Tracts and Bouldin Island	**Effect UT-4:** Inundation of Electrical Distribution Utilities on the Project Islands (LTS-M) **Mitigation Measure UT-MM-4:** Relocate Electrical Distribution Lines to the Perimeter Levees around Webb and Holland Tracts and Bouldin Island No change.
Impact E-20: Possible Need to Increase Capacity of the Existing Electrical Distribution Lines on the Reservoir Islands (LTS) **Mitigation:** No mitigation is required.	**Effect UT-5:** Possible Need to Increase Capacity of the Existing Electrical Distribution Lines on the Project Islands (LTS) **Mitigation:** No mitigation is required. No change.
Impact E-21: Possible Need to Expand the Existing Electrical Distribution Lines on Webb Tract, Bouldin Island, and Holland Tract to Serve Proposed Siphon and Pump Stations and Recreation Facilities (LTS-M) **Mitigation Measure E-2:** Extend Electrical Distribution	**Effect UT-6:** Possible Need to Expand the Existing Electrical Distribution Lines on Webb Tract, Bouldin Island, and Holland Tract to Serve a Proposed Siphon Station (LTS-M) **Mitigation Measure UT-MM-3:** Extend Electrical Distribution Lines to Serve New Siphon and Pump Stations

Table 3.18-1 Comparison of Delta Wetlands Project 2001 FEIS to this SEIS Effects and Mitigation Measures for Utilities and Service Systems	
2001 FEIS Effects and Mitigation Measures	SEIS Effects and Mitigation Measures
Lines to Serve New Siphon and Pump Stations and Recreation Facilities	The effect analysis and mitigation measure have been updated to reflect the fact that no new recreation facilities would be constructed.
Impact E-24: Increase in Demand for Water Supply Services (LTS) No mitigation required, but implementing mitigation will further reduce the level of impact. **Mitigation Measure E-7:** Obtain Appropriate Local and State Permits for Recreation Facility Services and Utilities	**Effect UT-7:** Increase in Demand for Water Supply Services (NI) **Mitigation:** No mitigation is required. The effect analysis and conclusion have been updated and the mitigation measure has been removed to reflect the fact that no new recreation facilities would be constructed.
Impact E-25: Increase in Demand for Sewage Disposal Services (LTS) No mitigation required, but implementing mitigation will further reduce the level of impact. **Mitigation Measure E-7:** Obtain Appropriate Local and State Permits for Recreation Facility Services and Utilities	**Effect UT-8:** Increase in Demand for Sewage Disposal Services (NI) **Mitigation:** No mitigation is required. The effect analysis and conclusion have been updated and the mitigation measure has been removed to reflect the fact that no new recreation facilities would be constructed.
Impact E-26: Increase in Demand for Solid Waste Removal (LTS) No mitigation required, but implementing mitigation will further reduce the level of impact. **Mitigation Measure E-7:** Obtain Appropriate Local and State Permits for Recreation Facility Services and Utilities	**Effect UT-9:** Increase in Demand for Solid Waste Removal (LTS) **Mitigation:** No mitigation is required. The effect analysis has been updated and the mitigation measure has been removed to reflect the fact that no new recreation facilities would be constructed.
Discussed in text but not numbered as an impact.	**Effect UT-10:** Effects to Infrastructure Facilities on Adjacent Islands (NI) **Mitigation:** No mitigation is required. No change.

Notes: Shading denotes changes in the effect, significance conclusion, or mitigation measure from the 2001 FEIS; LTS = Less than significant; LTS-M = Less than significant with mitigation; NI = No impact

Sources: ICF 2010:4.4-2 through 4.4-9 and AECOM 2014

3.18.6 SECONDARY AND CUMULATIVE IMPACTS

Secondary and cumulative effects on utilities and service systems from implementing the project were described in the 2001 FEIS (Chapter 3E) and the 2010 DEIR (Chapter 5). The 2001 FEIS and 2010 DEIR are herein incorporated by reference, and the effects conclusions and mitigation measures, along with any changes, are summarized briefly below and shown in Table 3.18-2.

Cumulative Decrease in the Risk of Structural Failure of Utilities

Risk of levee failure directly affects risk to utility stability, so cumulative levee failure would result in cumulative utility structural failure. As discussed in Section 3.9, “Floodplain Management,” implementation of flood control programs such as the California Department of Water Resources’ Delta water management programs and levee maintenance programs would improve the regional flood control system and reduce flood-related risks to adjacent utilities. The project also includes levee improvements on the project islands. Therefore, the cumulative risk of levee failure would be less than the current risk, and a beneficial effect on utilities is predicted.

Cumulative Disruption of Utility Services

The levee improvements and management of the four islands associated with the project have the potential to disrupt existing utilities, but measures included in the project and as mitigation would ensure that there are no disruptions to service. Other projects considered in this cumulative analysis, such as levee and road improvements and restoration, also could disrupt these services. However, pipelines, electrical lines, and other utilities generally have right-of-way or senior rights, and project proponents would coordinate with the owners/operators of these utilities to ensure there is minimal disruption of service. Therefore, the project would not result in a cumulatively considerable contribution to disruption of utility services in the region.

Table 3.18-2
Comparison of Secondary and Cumulative Utilities and Service Systems Effects between the 2001 FEIS and this SEIS

2001 FEIS Cumulative Effects and Mitigation Measures	SEIS Cumulative Effects and Mitigation Measures
Impact E-27: Cumulative Decrease in the Risk of Structural Failure of Roadways and Utilities (B) **Mitigation:** No mitigation is required.	Cumulative Decrease in the Risk of Structural Failure of Utilities (B) **Mitigation:** No mitigation is required. No change.
Not previously analyzed.	Cumulative Disruption of Utility Services (NCC) **Mitigation:** No mitigation is required.

Notes: Shading denotes changes in the effect, significance conclusion, or mitigation measure from the 2001 FEIS; NCC = Not cumulatively considerable; B = Beneficial

Sources: ICF 2010:5-31 and AECOM 2014

Exhibit 3.18-1

Natural Gas Transmission Lines

Source: ICF 2010, adapted by AECOM in 2014

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3.19 WATER SUPPLY

3.19.1 INTRODUCTION

This section describes recent changes to the existing environmental conditions and regulatory framework/ applicable laws, regulations, plans, and policies of the project study area, summarizes the unchanged affected environment, and describes changed environmental effects related to water supply and conservation and water rights for the project. A review and update of the 1995 DEIR/EIS water supply assessment was incorporated in the 2001 FEIS. Chapter 3A in the 2001 FEIS provided detailed information regarding water supply and water rights associated with the project and in the Sacramento-San Joaquin Delta (Delta) in general. The water supply effects of the project were analyzed most recently in Section 4.1 and Chapter 5 of the 2010 DEIR, which also served as a basis for this analysis. The 1995 DEIR/EIS, 2001 FEIS, and 2010 DEIR are herein incorporated by reference.

This section discusses Delta conditions related to water supply (the amount of water available for beneficial uses) and the possible effects of project operations on the existing water supplies from the Delta. Beneficial uses of Delta water include in-Delta uses (e.g., crop irrigation, drinking water) by other riparian or water rights holders, protection of fish and wildlife habitat, and exports for contractors receiving water from the Central Valley Project (CVP) or the State Water Project (SWP). The effects of movement of water in Delta channels (e.g., changes in channel flows and stages) are evaluated in Section 3.11, “Hydrology and Water Quality.”

The water supply and conservation and water rights effects assessment focuses on the potential project effects on existing water users in the Delta. The potential effects on CVP and SWP Delta operations and the operations of Contra Costa Water District (CCWD), Amador County, California Department of Water Resources (DWR), U.S. Bureau of Reclamation (Reclamation), North Delta Water Agency, and City of Stockton are assumed to be avoided through adherence to the operational criteria and stipulated agreements and protest dismissal agreements, which have been incorporated into the project as environmental commitments and are described in Chapter 2, “Project Description and Alternatives.” Results from modeling prepared to simulate project operations indicate that the project would not reduce the water supply of any CVP or SWP contractors.

This section considers effects on the existing Delta water supply conditions that result from upstream reservoir operations and irrigation diversions for the full range of watershed rainfall and runoff, as represented by the historical 1922–2003 monthly runoff for the Central Valley tributaries to the Delta. All of the existing reservoirs and water demands for municipal, agricultural, and wildlife refuge uses are included in the CALSIM modeling described in Chapter 2, “Project Description and Alternatives.” The small changes in evaporation from the project islands evaluated in the 2001 FEIS remain the same.

The project is assumed to operate separately from the integrated CVP and SWP reservoir and export pumping. This allows the results from the current CALSIM modeling of the existing CVP and SWP facilities and reservoir operations and permitted Delta operations (D-1641) to be used as the existing baseline conditions for evaluating project operations and potential effects on Delta riparian water users, Delta appropriative water rights diverters (such as Antioch, CCWD, and the City of Stockton), and the CVP contractors and SWP contractors.

Identification of the places of use has no effect on the effect analysis and conclusions related to water supply that were contained in the 2001 FEIS, because this water supply and conservation and water rights section discusses the amount of water available for beneficial uses in the Delta and the possible effects of project operations on the existing water supplies from the Delta. Water supply and conservation and water rights effects related to the places of use (if any), are discussed in the “Secondary and Cumulative Effects” subsection below and in Chapter 4, “Other Statutory Requirements.”

SUMMARY OF CHANGES, NEW CIRCUMSTANCES, AND NEW INFORMATION

Substantial Changes in the Project

Since the 2001 FEIS was completed, there have been no substantial changes in the project resulting in new significant adverse effects or substantial increase in the severity or intensity of effects related to water supply and conservation and water rights.

New Circumstances

Since the 2001 FEIS was completed, there have been no substantial new circumstances resulting in new significant adverse effects or substantial increase in the severity or intensity of effects related to water supply and conservation and water rights.

The major Delta water rights decision controlling the existing CVP and SWP Delta operations continues to be D-1641, which implements the Delta objectives established by the State Water Resources Control Board (SWRCB) in the 1995 Water Quality Control Plan (WQCP). The 1995 WQCP was reviewed and updated by SWRCB in 2006, with no major changes in the Delta flow or salinity objectives for beneficial water uses or for fish and wildlife protection.

CCWD has constructed a new (alternative) water intake on Victoria Canal, and the City of Stockton has constructed a new intake on the San Joaquin River at Empire Tract. A water supply intake was constructed in 2007 near the SWP Harvey O. Banks Pumping Plant (SWP Banks) to service the Mountain House community.

New Information

Since 2001, several new investigations of Delta water supply conditions have been prepared by the U.S. Bureau of Reclamation (Reclamation) and California Department of Water Resources (DWR) or through CALFED-funded additional monitoring, research, and restoration efforts. The most relevant of these studies for the project water supply circumstances in the Delta are summarized here.

In-Delta Storage Investigations

DWR investigated in-Delta storage as part of the Integrated Storage Investigation (ISI) for CALFED. These studies evaluated the Reservoir Islands as a storage facility that would be integrated with the other CVP and SWP reservoirs. This integrated operation was somewhat different from the independent project operations that are being evaluated in this section, but it provides valuable information about potential project operations and possible environmental effects and benefits from in-Delta storage operations. These studies generally confirmed that there is unused surplus outflow in a majority of water years (about 75%) that could be diverted to an in-Delta storage facility without interfering with any existing CVP or SWP water supply or Delta water diversion. These studies confirm that San Luis Reservoir is filled to capacity in many years, so that additional in-Delta storage would increase the seasonal water supply.

State Water Project Water Supply Reliability

Another new source of information was the CALSIM modeling studies prepared by the DWR Bay-Delta Office on the SWP water supply reliability (California Department of Water Resources 2008). This water supply reliability report is updated on a 2-year cycle and discusses the SWP demands (i.e., SWP Table A contract amounts) and the annual SWP allocations (percent of Table A delivery projections) that are based on hydrologic conditions and various Delta constraints. The CALSIM model results demonstrate that SWP water supplies are substantially reduced from Table A contract amounts in many years. The difficulties of delivering the full SWP Table A contract amounts with the existing facilities (including the 6,680-cubic feet per second [cfs]) limit on SWP Banks pumping) are described in the SWP water supply reliability report. The most recent reliability report describes the substantial reductions in SWP deliveries that would result from any limits on Old and Middle River (OMR) flows during the January–June period for delta smelt or Chinook salmon protection.

Central Valley Project–State Water Project Operations Criteria and Plan Evaluations

The Biological Assessment (BA) and Biological Opinion (BO) documents for the CVP-SWP Operational Criteria and Plan (OCAP) have been reviewed for new information about possible future water supply conditions. The BA for OCAP was expanded and updated (U.S. Bureau of Reclamation 2008) by Reclamation and DWR. The revised BO from U.S. Fish and Wildlife Service (USFWS) for delta smelt was released (U.S. Fish and Wildlife Service 2008) and included new restrictions on reverse OMR during the months of December–June. The revised BO from the National Marine Fisheries Service (NMFS) for Chinook salmon, steelhead, and sturgeon was released (National Marine Fisheries Service 2009) and also included OMR restrictions that will limit the existing conditions for CVP and SWP export pumping. Whatever these new restrictions on CVP and SWP Delta operations may require, the project would not interfere with or otherwise limit the existing water supply conditions.

The relationships between Delta flows or exports and biological conditions will continue to be controversial, and the effects of operations on biological resources will be monitored intensively by the Interagency Ecological Program (IEP) agencies. The effects of Delta operations will continue to be reviewed periodically, and the Delta objectives and export limits likely will be modified under adaptive environmental management principles. These OCAP evaluations have not included an in-Delta storage facility, so the basic operations of the project cannot be determined from the OCAP studies. This SEIS continues (as in previous environmental documents prepared for the Delta Wetlands project) to evaluate the project as an independent facility and does not consider integrated operations with the CVP and SWP.

Future Delta Conditions Studies

Several future Delta planning studies have been completed since the 2001 FEIS, and planning studies related to CVP and SWP operations are continuing. The OCAP studies appear to be ongoing, with revisions and changes every few years. The more recent Bay Delta Conservation Plan (BDCP) is the major planning effort focused on alternative conveyance and habitat restoration (e.g., land conversion) options for protection and recovery of Endangered species in the Delta. These planning studies are briefly described in Chapter 2, “Project Description and Alternatives.”

The possible effects of changes in the future CVP and SWP Delta operations on project operations are not considered in this SEIS. In any of these future Delta scenarios (i.e., configurations or operations), the basic assumption that the project would not interfere with or limit the existing water users in the Delta, or reduce the water supply available for any existing water right or CVP or SWP contractor, remains valid.

SUMMARY OF ENVIRONMENTAL COMMITMENTS

Environmental commitments are measures incorporated by the project applicant as part of the project, meaning they are proposed as elements of the Proposed Action and are therefore considered in conducting the environmental analysis for each resource area of this SEIS. The purpose of environmental commitments is to reflect and incorporate best practices into the project that avoid, minimize, reduce, or offset potential environmental effects. A complete description of the environmental commitments that have been incorporated into the project since the 2001 FEIS is contained in Chapter 2, “Project Description and Alternatives” of this SEIS.

In response to the 1997 State Water Board water right hearing, 18 parties filed protests with SWRCB against the project applicant’s water rights applications. The project applicant entered into negotiations with some of these parties. The project applicant entered into stipulated agreements with Reclamation, DWR, Amador County, the

City of Stockton, and North Delta Water Agency that affirm the seniority of these parties' water rights. These agreements were summarized in Appendix A of the 2000 RDEIR/EIS (herein incorporated by reference). Following the 2000 water rights hearings, the project applicant signed protest dismissal agreements with CCWD, which protects the Los Vaqueros Reservoir water rights and operations, including diversions for salinity control (reduction), and with California Urban Water Agencies (CUWA) and East Bay Municipal Utility District (EBMUD). These stipulated agreements define how the project would be operated independent of, and in a manner that does not adversely affect, the CVP and SWP Delta operations. These stipulated agreements provide the basis for assuming that the project operations will not affect existing water rights and water supply in the Delta.

These protest dismissal agreements also include the WQMP (described in Chapter 2, "Project Description and Alternatives"), which provides several requirements for daily flow, salinity, and dissolved organic carbon (DOC) monitoring, as well as modeling and accounting for the contribution of project discharges and releases at the water supply intakes. Additional details about the water quality monitoring and modeling are provided in Section 3.11, "Hydrology and Water Quality."

The project operations would be tracked with daily water accounting. DWR Division of Operations and Maintenance, in cooperation with Reclamation's Central Valley Operations Center (CVOC), maintains daily water budget estimates for the Delta and designates the Delta condition each day as being "in balance" or "in excess" relative to all SWRCB objectives and water right terms and conditions. When the Delta condition is designated by DWR and Reclamation to be in balance, all Delta inflow is determined to be required to meet Delta objectives and satisfy diversions by CCWD, the CVP, the SWP, other senior water right holders, and Delta riparian water users. Therefore, when the Delta is in balance, additional water would not be available for diversion by the project.

When DWR (and Reclamation) determine the Delta condition to be in excess, the project would be allowed to divert available excess water for storage on the Reservoir Islands. The daily quantity of available excess water would be estimated according to the normal Delta water supply accounting procedures. To provide extra protection for compliance with 2006 WQCP Delta objectives (D-1641) and for existing water right holders, SWRCB may establish requirements for amounts of water within the designated excess water (buffers) that would be available for project diversions. Even with additional SWRCB-established safeguards in place, excess Delta inflow is available for diversion during certain periods, especially major runoff events.

Project operations would not be permitted to interfere with senior appropriative water right holders or Delta riparian users. Following the 1997 water rights hearings, the project applicant entered into stipulated agreements with Reclamation, DWR, Amador County, the City of Stockton, and North Delta Water Agency. These agreements affirm the seniority of these parties' water rights; they also outline general conditions under which the project would operate to preclude interference with those water rights or with a party's ability to meet particular water quality criteria. Additional information about the terms of these agreements is available in Chapter 2, "Project Description and Alternatives."

The project must submit timely reports to SWRCB on the operations of each Reservoir Island, as well as the Delta conditions that may affect project diversions and discharges for export or releases for Delta outflow. These monitoring and reporting requirements are similar to mitigation monitoring required for other water projects. Although there are no significant water supply effects from project implementation or operations, these monitoring and reporting requirements (under the protest dismissal agreements) would provide an accurate record of project operations and water supply and water quality benefits.

3.19.2 AFFECTED ENVIRONMENT

The "Affected Environment" subsection for water quality in the 2001 FEIS (Chapter 3A) discussed water rights; Delta objectives and requirements for protection of water quality and biological resources and the constraints placed on Delta water project operations by these objectives and requirements; and operations of the SWP and CVP. An update to that information is provided in this SEIS in Section 3.11, "Hydrology and Water Quality." New modeling of water supply operations conducted since the 2001 FEIS, which forms the basis for the water supply effects herein, is presented in Chapter 2, "Project Description and Alternatives." The water supply and conservation and water rights discussion contained in the 2001 FEIS is herein incorporated by reference, and is summarized and updated below.

DELTA WATER RIGHTS

Numerous parties hold rights to divert water from the Delta and upstream tributaries. The reasonable beneficial requirements of existing riparian and senior appropriative users with regard to both water quantity and water quality must not be impaired by exercise of subsequent appropriative water rights. DWR's SWP and Reclamation's CVP and other water rights holders divert water from the Delta under appropriative rights. More than 1,000 siphons and pumps are used to divert water under riparian and appropriative rights from Delta channels. Project operations would be conducted under existing riparian and appropriative water rights and new appropriative rights.

Riparian water rights are entitlements to water that are held by owners of land bordering natural flows of water. A landowner has the right to divert a portion of the natural flow for reasonable and beneficial use on his or her land within the same watershed. If natural flows are not sufficient to meet reasonable beneficial requirements of all riparian users on a stream, the users must share the available supply according to each owner's reasonable requirements and uses.

Appropriative rights are held in the form of conditional permits or licenses from SWRCB. These authorizations contain terms and conditions to protect prior water right holders and to protect the public interest in fish and wildlife resources. SWRCB reserves jurisdiction to establish or revise certain permit or license terms and conditions for salinity control, protection of fish and wildlife, protection of vested water rights, and coordination of terms and conditions among the major water supply projects.

Various water quality and flow objectives have been established by SWRCB to ensure that the quality of Delta water is sufficient to satisfy all designated uses; implementation of these objectives requires that limitations be placed on Delta water supply operations, particularly operations of the SWP and CVP, affecting amounts of fresh water and salinity levels in the Delta. The project would be prohibited from affecting the ability of those holding prior water rights, such as DWR and Reclamation, to exercise those rights, and the project would not be allowed to interfere with compliance with Delta water quality standards or protection of biological resources.

Diversion and storage of water in upstream reservoirs by California's two major water supply projects, DWR's SWP and Reclamation's CVP, and diversion and export of water from the Delta, are authorized and regulated by SWRCB under appropriative water rights. The SWP and the CVP store and release water upstream of the Delta and export water from the Delta to areas generally south and west of the Delta. Reclamation diverts water from the Delta through its CVP Jones Pumping Plant (CVP Jones) to the Delta-Mendota Canal (DMC) and San Luis Canal, and DWR pumps for export through the California Aqueduct and South Bay Aqueduct at its SWP Banks Pumping Plant. DWR also operates the North Bay Aqueduct, which diverts water at the Barker Slough Pumping Plant. A third substantial diverter of Delta water is CCWD, which currently diverts water from Mallard Slough near Pittsburg (when outflow is high), from Rock Slough, from the Los Vaqueros intake on Old River, and a new intake on Victoria Canal put in operation in June 2010. Several municipal users (e.g., Antioch, Mountain House) and many agricultural users also divert water from the Delta under riparian and appropriative rights. Stockton has constructed a water supply intake on Empire Tract.

Delta Regulatory Limits

The limits on SWP Banks and CVP Jones pumping sometimes restrict the Delta exports to less than the full CVP and SWP demands for Delta exports. These regulatory limits result from Delta outflow requirements, Delta salinity objectives, export/inflow limits, and permitted or physical export pumping capacity. The project would provide additional water for summer and fall exports in July–November to supply some of the unmet SWP water demands (i.e., delivery deficit). SWRCB's Water Rights Division has primary regulatory authority over water supplies and issues permits for water rights specifying amounts and conditions for diversion and storage facilities.

2006 Water Quality Control Plan and D-1641

The SWRCB implemented the 1995 WQCP with Water Right Decision 1641 (D-1641) in March 2000 (State Water Resources Control Board 1999). The most recent version of the WQCP was adopted by SWRCB in 2006. The provisions for X2, export/import (E/I) ratio, and the Vernalis Adaptive Management Plan (VAMP) that are implemented in D-1641 are summarized in Chapter 2, "Project Description and Alternatives." The modeling of the project assumed that none of the CVP or SWP Delta operations to meet these regulatory criteria would be changed with project operations. The project therefore was assumed to satisfy these regulatory limits and to cause no effects on Delta water users or to CVP or SWP contractors.

Endangered Fish Species Protection

The Endangered Species Act requires assessment of the effects of water project operations on fish species listed as Threatened or Endangered. NMFS issued a revised (updated) BO on the effects of SWP and CVP operations on Chinook salmon, steelhead, and green sturgeon in June 2009. The USFWS issued a revised (updated) BO on the effects of SWP and CVP operations on delta smelt in December 2008. These BOs include reasonable and prudent measures (requirements) for Delta outflow, Delta Cross Channel (DCC) gate closure, reverse OMR flow restrictions, and reduced export pumping for fish protection. These fish protection requirements impose additional constraints on Delta water supply operations. The project would not interfere with CVP and SWP compliance with these measures. The project would obtain revised (updated) BOs from NMFS and USFWS, as well as an incidental take permit from California Department of Fish and Wildlife (DFW), that would specify constraints on project operations for fish protection. These project criteria are expected to be somewhat similar to the previously developed final operating criteria (FOC) included in the 1997 project BOs. Chapter 2, "Project Description and Alternatives," describes the FOC in more detail.

Delta Water Transfers

The California Legislature has passed several laws to encourage water transfers beyond the boundaries of historical water service areas. These laws protect water users who are not a party to the transfer and also protect fish and wildlife from effects caused by the water transfer. The SWRCB has established a process to expand the place of use of those conducting a short-term (1-year) water transfer. Several long-term transfers also have been negotiated and permitted. The most recent is the Yuba Accord, which includes increased minimum flows for fish habitat protection, and a long-term transfer of about 60 thousand-acre feet (taf) to DWR for use by the Environmental Water Account (EWA) for fish entrainment reduction.

In previous drought years, substantial water transfers through the Delta have occurred. About 800 taf were purchased for transfer in 1991 as a part of DWR's Drought Water Bank, the largest water transfer year on record. The amount of additional water that was actually pumped at SWP Banks Pumping Plant in 1991 is more difficult to determine. Beginning in 1995, California experienced a series of higher-than-normal runoff years, and the need for water transfers decreased during the wet years. In 2001 (a dry year) the EWA purchased and transferred 105 taf, and other parties transferred about 360 taf, making use of the CVP and SWP pumping plants for diversion from the Delta. In 2002, the EWA transferred 142 taf from upstream of the Delta, and other parties transferred additional water through the Delta. The EWA made upstream purchases of about 100 taf in subsequent years

(2003 and 2004), but because there is no centralized reporting or accounting (i.e., neither SWRCB nor DWR) for water transfers, the importance of this Delta water management activity is difficult to determine.

The project would be a major new source of water transfers. The water diverted onto the project storage islands would have previously flowed into Suisun Bay during relatively high-flow periods, when estuarine habitat benefits from outflow might be relatively small. Project storage water would be diverted when Delta outflow was high and the environmental effects of (fish-screened) diversions would be relatively small (See Section 3.4, “Aquatic Resources”). Project storage water would be transferred to designated places of use when unused permitted SWP or CVP export capacity and aqueduct conveyance capacity were available in the months of July–November. The months of July–September have been identified in other water transfer evaluations (e.g., EWA, Yuba Accord, and OCAP) as months when additional export pumping may be the least harmful to fish. Project water could be delivered directly to the places of use in some years, or stored in groundwater banks with delivery to designated places of use in subsequent water years.

The project operations would not interfere with senior legal water diversions within the Delta or the existing CVP and SWP operations. The project is evaluated as an independent project and is assumed not to change any existing CVP or SWP Delta operations that are controlled by the existing SWRCB objectives (D-1641). These baseline Delta water supply operations and the simulated changes in Delta flows caused by the project are fully described in Chapter 2, “Project Description and Alternatives.” These results are briefly evaluated for water supply effects in this section and evaluated for effects on water quality and fish habitat and abundance in other sections of this SEIS.

3.19.3 Regulatory Framework/Applicable Laws, Regulations, Plans, and Policies

Federal applicable laws and regulations are provided because they are required under NEPA. State applicable laws and regulations are provided for informational purposes and to assist with NEPA review. USACE has considered applicable state, regional, and local plans and ordinances as a part of the environmental review process for this SEIS, where applicable.

Federal and State

Federal, state, and local regulations are effectively integrated within the state water rights and water quality control planning framework, administered by SWRCB, to protect beneficial uses in the Delta. Various water quality and flow objectives have been established by SWRCB to protect all designated beneficial uses; implementation of these objectives in D-1641 requires various limitations on the operations of the south Delta SWP and CVP export pumps, which affect Delta outflow and corresponding salinity levels in the Delta.

The SWP and CVP divert water from the Delta under appropriative rights. Appropriative rights are held in the form of conditional permits or licenses from SWRCB. At times, Delta exports are restricted to less than the full CVP and SWP demand. These regulatory limits result from Delta outflow requirements, Delta salinity objectives, export/inflow limits, and permitted or physical export pumping capacity. SWRCB’s1995 WQCP and the *Final EIR for Implementation of the 1995 Bay/Delta Water Quality Control Plan* incorporated several elements of the EPA, NMFS, and USFWS regulatory objectives for salinity and endangered species protection. The changes from the previous regulatory limits for CVP and SWP Delta operations were substantial and are discussed above.

Several BOs for CVP and SWP operations have been issued by NMFS and USFWS, as discussed above. These fish protection requirements impose additional constraints on Delta water supply operations.

Finally, the California Legislature has passed several laws to encourage water transfers beyond the boundaries of historical water service areas, which are also discussed above.

The major Delta water rights decision controlling the existing CVP and SWP Delta operations continues to be D-1641, which implements the Delta objectives established by SWRCB in the 1995 WQCP. The 1995 WQCP was reviewed and updated by SWRCB in 2006, with no major changes in the Delta flow or salinity objectives for beneficial water uses or for fish and wildlife protection.

3.19.4 ANALYSIS METHODOLOGY

Project diversions to storage and releases for export or water quality enhancement could affect water supply in the Delta through changes in channel flow quantity, timing, and water quality.

The settlement agreements with Reclamation, DWR, CUWA, and CCWD include provisions to ensure that project operations would not result in adverse effects on water supply in the Delta or for CVP and SWP contractors. Those provisions have been incorporated into the project, as described in Chapter 2, "Project Description and Alternatives."

Project operations were simulated with a monthly spreadsheet model, developed by MBK Engineers (MBK). The project operations model is called In-Delta Storage Model (IDSM). The model formulations and assumptions are described in Appendix D, "Delta Wetlands Project In-Delta Storage Model." The project operations model begins with the results from a selected CALSIM baseline simulation. The 1922–2003 rainfall and runoff record used for the CALSIM baseline represents the existing hydrologic conditions (i.e., sequence) for this water supply and the project operations evaluation. The CALSIM model simulates the operation of the existing CVP and SWP reservoirs to meet the water supply demands in the CVP and SWP service areas. The modeling results are described in detail in Chapter 2, "Project Description and Alternatives."

The monthly water supply simulation provides a quantitative approach for evaluating the project operations—the diversions to storage, the discharge and export pumping and delivery to designated places of use or groundwater banks, and the release for increased Delta outflow. The operations of the groundwater banking facilities and delivery to designated places of use have also been simulated.

SIGNIFICANCE CRITERIA

The basis for determining the significance of effects for this analysis is based on professional standards, project-specific criteria developed by the lead agency to address potential effects unique to the project's location and elements, and is informed by the criteria contained in the Environmental Checklist in Appendix G of the State CEQA Guidelines. These thresholds encompass the factors taken into account under NEPA to determine the significance of an action in terms of its context and the intensity of its effects. The Proposed Action or alternatives under consideration would have a significant, adverse (detectable) effect on Delta consumptive use if it would cause an increase in Delta lowland evapotranspiration (ET) exceeding 1% of the No-Action Alternative ET from Delta lowlands (of about 890 thousand-acre feet per year [taf/yr]). This significance criterion also could be expressed as a change of more than 20% of the consumptive use on the project islands (44 taf/yr) because the project islands represent about 5% of the area of the Delta lowlands. A project is considered to have a beneficial effect on Delta consumptive use if it would cause a decrease in Delta lowland ET. Potential effects of the project on increased water supply and resulting growth-inducing or cumulative effects in the designated places of use are described in the "Secondary and Cumulative Effects" subsection below and in Chapter 4, "Other Statutory Requirements."

3.19.5 ENVIRONMENTAL CONSEQUENCES AND MITIGATION MEASURES

EFFECTS ANALYSIS

The project diversions, storage, discharge for exports, and releases for outflow would not interfere with any existing water users in the Delta and would not reduce the delivery to any CVP or SWP contractor. The project releases for outflow would substantially reduce export salinity in some fall months of some years and provide a water quality benefit to many Delta water users and CVP and SWP contractors, as described more fully in Section 3.11, "Hydrology and Water Quality." The estimated consumptive water use for all alternatives is shown in Table 3.19-1.

Table 3.19-1
Estimated Consumptive Water Use

Alternative	Consumptive Water Use (taf/yr): Stored Water Evapotranspiration (ET)[a]	Consumptive Water Use (taf/yr): Stored Water Evaporation	Consumptive Water Use (taf/yr): Total	Change in Consumptive Use as Compared to No-Action
No-Action Alternative (17,500 irrigated acres)	44[b]	0	44	N/A
Alternative 1 (two Reservoir Islands and two Habitat Islands)	14	34	48	+4
Alternative 2 (Proposed Action) (two Reservoir Islands and two Habitat Islands)	14	23	37	-7
Alternative 3 (four Reservoir Islands)	0	54	54	+10
No-Action Alternative Cumulative	44[b]	0	44	N/A
Alternative 1 Cumulative	14	25	39	-5
Alternative 2 (Proposed Action) Cumulative	14	14	28	-16
Alternative 3 Cumulative	0	32	32	-12

Notes: taf/yr = thousand acre-feet per year; N/A = not applicable

[a] Evapotranspiration (ET) on Habitat Islands consists of ET from crops grown for habitat purposes plus ET from flooded wetlands.

[b] Represents total ET on all four project islands under intensified agriculture; wildlife habitat is not specifically developed or managed under the No-Action Alternative.

Source: ICF 2001: Table 3A-5; adapted by AECOM in 2013

Effects on water supply resulting from implementing the project were described in the 2001 FEIS and are listed in Table 3.19-2. Where there have been no changes to the effect analysis or conclusions, the 2001 FEIS is incorporated by reference, and the effects conclusions and mitigation measures are summarized briefly in the following section.

No-Action Alternative

EFFECT WS-1 **Change in Delta Consumptive Use.** *Intensified agricultural uses would not result in a substantial change in Delta consumptive water use. This effect is less than significant.*

The consumptive use for the No-Action Alternative was estimated for the four project islands, which are located in Delta lowlands (i.e., peat soils), to be approximately 44 taf/yr (see Table 3.19-1). This is the existing consumptive use for the four project islands (17,500 irrigated acres) under existing riparian and appropriative water rights for agricultural and other beneficial purposes. Under the No-Action Alternative, consumptive use could increase, but not measurably so at the scale of monthly water supply modeling. Therefore, this effect is **less than significant**.

Alternative 1

EFFECT WS-1 Change in Delta Consumptive Use. *Conversion of the project islands from agriculture to water storage and wildlife habitat management would slightly increase the Delta consumptive use of water (from evaporation and/or crop transpiration). This effect is less than significant.*

Under Alternative 1, land uses would change from irrigated agriculture to primarily water storage on the Reservoir Islands and to wildlife habitat and wildlife feed crops on the Habitat Islands. As shown in Table 3.19-1, these land use changes would reduce ET from a total of 44 taf/yr to 14 taf/yr (the 2001 FEIS estimated ET amount from the Habitat Islands) for the four islands. Additionally, an average of approximately 34 taf/yr of evaporation would be lost from stored water on the Reservoir Islands during periods of water storage, somewhat more than under Alternative 2 because of increases in storage duration. An unknown amount of evaporation from moist soil and possibly from seepage would continue to be lost on the Reservoir Islands directly after total drawdown. Also, an ET amount approximately equal to the ET for the Habitat Islands (14 taf) would be lost during periods when the Reservoir Islands are in a shallow-water wetland condition.

Total consumptive use on the four project islands is expected to increase by approximately 4 taf/yr compared with use under the No-Action Alternative as a long-term average. Accounting of project operations would be required under the protest dismissal agreements. This effect is **less than significant**.

Mitigation Measure: No mitigation is required.

Alternative 2 (Proposed Action)

EFFECT WS-1 Change in Delta Consumptive Use. *Conversion of the project islands from agriculture to water storage and wildlife habitat management would reduce the Delta consumptive use of water (from evaporation and/or crop transpiration). This effect is beneficial and less than significant.*

Alternative 2 was simulated as the Proposed Action with the IDSM model as described in Chapter 2, "Project Description and Alternatives." The simulated monthly project diversions, discharges for export pumping, and releases for Delta outflow in the fall months were slightly different from the operations previously simulated for the 2001 FEIS. However, the consumptive uses were assumed to be the same as for the 2001 FEIS.

Under Alternative 2, as shown in Table 3.19-1, Habitat Island ET is estimated to average 14 taf/yr, and evaporation of stored water would average approximately 23 taf/yr. Total consumptive use under Alternative 2 is estimated to average approximately 7 taf/yr less than under the No-Action Alternative. Accounting of project operations would be required under the protest dismissal agreements. This is a **beneficial, less-than-significant** effect.

Mitigation Measure: No mitigation is required.

Alternative 3

EFFECT WS-1 Change in Delta Consumptive Use. *Conversion of the project islands from agriculture to water storage and wildlife habitat management would substantially increase the Delta consumptive use of water (from evaporation and/or crop transpiration). This effect is significant.*

Under Alternative 3, as shown in Table 3.19-1, evaporation of stored water from all four project islands is estimated to average 54 taf/yr (as stated in the 2001 FEIS). Because all four islands would be operated as Reservoir Islands, there would be essentially no Habitat Island ET as under Alternatives 1 and 2, except for ET from a small portion of Bouldin Island. Total consumptive use under Alternative 3 is estimated to average

54 taf/yr, which is approximately 10 taf/yr greater than under the No-Action Alternative. This increase in Delta consumptive use represents about a 1% increase in Delta lowland consumptive use and is significant. However, the consumptive use under Alternative 3 would be supplied by project diversions of surplus Delta outflow, whereas the No-Action Alternative consumptive use would be supplied by irrigation diversions in the summer. Accounting of project operations would be required under the protest dismissal agreements; however, the increase in project-related consumptive use would be **significant.**

Mitigation Measure: No feasible mitigation measures are available.

There are no feasible mitigation measures available to fully reduce the effect to a less-than-significant level. Therefore, this effect is **significant and unavoidable**.

Table 3.19-2
Comparison of Delta Wetlands Project 2001 FEIS to this SEIS Effects and Mitigation Measures for Water Supply

2001 FEIS Effects and Mitigation Measures	SEIS Effects and Mitigation Measures
Alternative 1	
Effect A-1: Increase in Delta Consumptive Use (LTS) **Mitigation:** No mitigation is required.	**Effect WS-1:** Change in Delta Consumptive Use (LTS) **Mitigation:** No mitigation is required. No change.
Alternative 2 (Proposed Action)	
Effect A-2: Reduction in Delta Consumptive Use (B) **Mitigation:** No mitigation is required.	**Effect WS-1:** Change in Delta Consumptive Use (B and LTS) **Mitigation:** No mitigation is required. No change.
Alternative 3	
Effect A-1: Increase in Delta Consumptive Use (SU) **Mitigation:** No mitigation is available.	**Effect WS-1:** Change in Delta Consumptive Use (SU) **Mitigation:** No mitigation is available. No change.

Notes: SU = Significant and unavoidable; LTS = Less than significant; B = Beneficial
Sources: ICF 2010:4.1-2 and AECOM 2013

3.19.6 SECONDARY AND CUMULATIVE EFFECTS

Secondary and cumulative effects on water supply resulting from implementing the project were described in the 2001 FEIS (Chapter 3A) and 2010 DEIR (Chapter 5). The 2001 FEIS and 2010 DEIR are herein incorporated by reference, and the secondary and cumulative conclusions and mitigation measures, along with any changes, are summarized briefly below and shown in Table 3.19-3.

The physical environmental effects from changes in water supply conditions are similar to potential changes in runoff and river flow. The change in flow is not itself considered a significant effect unless this change exceeds the normal range of flows for the river or stream channel. An increased water supply diversion would change the downstream flow, and an increased flow could allow increased diversions, but these changes are not considered to be significant effects unless the normal range of the water supply diversions would be exceeded. Nevertheless, two cumulative water supply effects have been identified and are discussed below.

Reduction in Delta Consumptive Use under Cumulative Conditions

Under cumulative conditions, as shown in Table 3.19-1, implementation of Alternatives 1, 2, or 3 would decrease Delta consumptive use as compared to the consumptive use estimated for the No-Action Alternative by 5 taf/yr, 16 taf/yr, and 12 taf/yr, respectively. Therefore, this cumulative effect is beneficial.

Increased Water Supplies Available for Export

Combining the project facilities and operations with existing Delta operations and cumulative potential future storage and conveyance projects, including Shasta Reservoir Enlargement, North-of-Delta Off-Stream Storage, Los Vaqueros Reservoir Expansion, Upper San Joaquin River Basin Storage, an isolated conveyance facility (under BDCP), and possible increases in Banks Pumping Plant permitted capacity (to 10,300 cfs) could result in increased water supplies available for export. It is assumed that these cumulative water supply projects, although all but the Los Vaqueros Reservoir Expansion Project are not reasonably foreseeable and are speculative, could have positive effects on Delta water supply conditions by improving the amount and timing of flow to the Delta, providing flexibility in timing of storage and release of water for exports, and increasing the amount and timing of water used to protect sensitive aquatic species in upstream tributaries, in the rivers and Delta channels, or with Delta outflow.

Implementation of the project would not contribute to any significant cumulative effects on water supply conditions, but is instead intended to improve reliability by increasing operational flexibility and storage in the system. Combined with the other projects listed above, it is expected that the overall water supply reliability would improve. The project would result in a small increase in overall water deliveries from the Delta, resulting in potential additional water supplies available for use south of the Delta. (See also Chapter 4, “Other Statutory Requirements.”)

In addition to the various projects listed above, the USFWS and NMFS BOs for OCAP include several additional CVP and SWP pumping restrictions (implemented as OMR reverse flow limits) to protect delta smelt and other fish from entrainment. These new restrictions in the months of January–June are likely to reduce the allowable total pumping by CVP and SWP and increase the need for full capacity pumping in the months of July–December. This will make the project more valuable for maintaining the maximum possible south-of-Delta water supply reliability with the existing south Delta intakes. The cumulative effects of these restrictions in terms of loss of regional water supply may be significant, but the project’s contribution could at least partially offset this cumulative loss of water supply. The project’s contribution to cumulative water supplies available for export therefore is beneficial.

Table 3.19-3
Comparison of Secondary and Cumulative Water Supply Effects between the 2001 FEIS and this SEIS

2001 FEIS Cumulative Effects and Mitigation Measures	SEIS Cumulative Effects and Mitigation Measures
Effect A-4: Reduction in Delta Consumptive Use (B) **Mitigation:** No mitigation is required.	Reduction in Delta Consumptive Use (B) **Mitigation:** No mitigation is required. No change.
Not previously evaluated	Increased Water Supplies Available for Export (B) **Mitigation:** No mitigation is required. New cumulative effect.

Notes: Shading denotes changes in the effect, significance conclusion, or mitigation measure from the 2001 FEIS; NCC = Not cumulatively considerable; B = Beneficial

Sources: ICF 2010:5-29 and AECOM 2013

4 OTHER STATUTORY REQUIREMENTS

4.1 GROWTH-INDUCING EFFECTS

4.1.1 INTRODUCTION

NEPA requires that an EIS address the indirect effects of an action or project, which may include growth-inducing effects and other effects related to induced changes in the pattern of land use; population density or growth rate; and related effects on air, water, and other natural systems or ecosystems (40 Code of Federal Regulations 1508[b]). An EIS must identify the effects that are known and make a good-faith effort to explain these effects; however, if there is uncertainty about these effects, an agency is not required to engage in speculation but should make a judgment based on reasonably foreseeable occurrences.

Growth-inducement itself is not an environmental effect, but it may foreseeably lead to indirect environmental effects. These indirect environmental effects may include increased demand on other community and public services and infrastructure, increased traffic and noise, degradation of air or water quality, degradation or loss of plant or animal habitats, or conversion of agricultural and open space land to urban uses.

4.1.2 GROWTH-INDUCING EFFECTS OF THE PROJECT

As discussed in detail in Chapter 2, “Project Description and Alternatives,” places of use for the project water have been identified as the service areas of Semitropic, Golden State, and Metropolitan and its member agencies. Figures 1-2 through 1-6 in Chapter 1, “Introduction” show the areas served by these water suppliers that may use project water. As described in Chapter 2, “Project Description and Alternatives,” Semitropic provides irrigation water to 140,000 acres of agricultural land in Kern County. Metropolitan provides municipal, industrial, and agricultural water supplies to a large area of southern California encompassing 5,200 square miles, which includes 152 cities and 89 unincorporated communities (see Table 2-2 in Chapter 2, “Project Description and Alternatives”). Golden State serves 75 communities throughout California; however, the regions of Golden State that would be served by project water are limited to the 33 water systems and 53 communities shown in Table 2-3 in Chapter 2, “Project Description and Alternatives.”

These places of use have demonstrated need and capacity for additional sources of water to improve the reliability of their existing water supplies to meet current demand, and have infrastructure in place for conveyance and transfer of the project water. Project water would be used to improve water supply reliability for their current water uses, which include irrigation, domestic, and municipal and industrial (M&I) beneficial uses.

Table 4-1 shows a detailed summary of the purpose of water use, geography served, and planned growth within each place of use.

The following water supply planning documents for the designated places of use were consulted for this analysis to determine the anticipated levels of growth and likely uses of project water at each place of use.

- GEI Consultants, Inc. 2007. *Upper Santa Ana River Watershed Integrated Regional Water Management Plan*. Prepared by GEI Consultants, Inc., in association with SAIC and GEOSCIENCE Support Services, Inc. for the Upper Santa Ana Water Resources Association. San Bernardino, CA.
- Golden State Water Company. 2005a. *2005 Urban Water Management Plan – Artesia. Final Report.* Anaheim, CA. Prepared by CH2MHill for Golden State Water Company.
- Golden State Water Company. 2005b. *2005 Urban Water Management Plan – Barstow. Final Report.* Ontario, CA. Prepared by CH2MHILL for Golden State Water Company.

Table 4-1
Summary of Planned Growth Within Each Place of Use

Entity	Estimated Annual Water Demand (taf)	Estimated Maximum Annual Delivery from Project (taf)[1]	Purpose of Use[2]	Geography Served	Relevant Planning Document	Anticipated Growth based on Planning Document
Semitropic Water Storage District	420	45	Increase water supply reliability for agricultural irrigation.	140,000 acres of agricultural land in Kern County	Poso Creek Integrated Regional Water Management Plan, published in 2007	2006 population in the Poso Creek planning area was 120,000. Population growth is anticipated to continue at approximately 5% per year. Agriculture is expected to decline accordingly.
Metropolitan Water District of Southern California	4,100[5]	215	Increase reliability of existing agricultural, industrial, and municipal water supplies.	5,200 square miles of residential, municipal, industrial, and agricultural land in southern California, including 152 cities and 89 unincorporated communities (see Table 2-2).	Metropolitan Water District of Southern California Regional Urban Water Management Plan, published in 2005	Population growth in Metropolitan's service area is expected to average just over 150,000 people per year, increasing from an estimated 18.2 million in 2005 to 22 million in 2030. Water demand is anticipated to increase to 4,914,000 acre-feet by 2030.
Golden State Water Company[3]	240[4]	20	Increase reliability of existing municipal and industrial deliveries.	53 communities in southern California (see Table 2-3)	19 Urban Water Management Plans, published in 2005	Population growth is expected to increase by approximately 18% by 2030. Among the service areas that have urban water management plans, the population in 2005 was 1,035,000 and is anticipated to be 1,230,000 by 2030; 80 new agricultural service connections are anticipated by 2030.

Notes: taf = thousand-acre feet

1. Denotes estimates of the maximum annual deliveries of Project water to each place of use, and not average deliveries. The sum of the estimated maximum annual deliveries exceeds anticipated Project yield. Maximum annual deliveries are used to conservatively assess the growth-inducing effects of the project.
2. No new facilities would be needed to convey to or store water at the places of use as a result of the project beyond those already built or those already analyzed and approved.
3. Numbers provided for the Golden State Water Company include only information for those delivery areas with urban water management plans.
4. Anticipated total water demand by 2030.
5. Interpolated demand for 2005, as presented in the Metropolitan Water District Regional Urban Water Management Plan (2005).
6. State Water Project Table A quantity.

Source: ICF 2001: 6-5 and 6-6; adapted by AECOM in 2013

- Golden State Water Company. 2005c. *2005 Urban Water Management Plan – Bay Point. Final Report.* Rancho Cordova, CA. Prepared by CH2MHILL for Golden State Water Company.
- Golden State Water Company. 2005d. *2005 Urban Water Management Plan – Bell-Bell Gardens. Final Report.* Anaheim, CA. Prepared by CH2MHILL for Golden State Water Company.
- Golden State Water Company. 2005e. *2005 Urban Water Management Plan – Claremont. Final Report.* Ontario, CA. Prepared by CH2MHILL for Golden State Water Company.
- Golden State Water Company. 2005f. *2005 Urban Water Management Plan – Cowan Heights. Final Report.* Ontario, CA. Prepared by CH2MHILL for Golden State Water Company.
- Golden State Water Company. 2005g. *2005 Urban Water Management Plan – Culver City. Final Report.* Anaheim, CA. Prepared by CH2MHILL for Golden State Water Company.
- Golden State Water Company. 2005h. *2005 Urban Water Management Plan – Florence-Graham. Final Report.* Anaheim, CA. Prepared by CH2MHILL for Golden State Water Company.
- Golden State Water Company. 2005i. *2005 Urban Water Management Plan – Norwalk. Final Report.* Anaheim, CA. Prepared by CH2MHILL for Golden State Water Company.
- Golden State Water Company. 2005j. *2005 Urban Water Management Plan – Ojai. Final Report.* Rancho Cordova, CA. Prepared by CH2MHILL for Golden State Water Company.
- Golden State Water Company. 2005k. *2005 Urban Water Management Plan – Orcutt. Final Report.* Rancho Cordova, CA. Prepared by CH2MHILL for Golden State Water Company.
- Golden State Water Company. 2005l. *2005 Urban Water Management Plan – Placentia. Final Report.* Ontario, CA. Prepared by CH2MHILL for Golden State Water Company.
- Golden State Water Company. 2005m. *2005 Urban Water Management Plan – San Dimas. Final Report.* Ontario, CA. Prepared by CH2MHILL for Golden State Water Company.
- Golden State Water Company. 2005n. *2005 Urban Water Management Plan – Santa Maria. Final Report.* Santa Maria, CA. Prepared by CH2MHILL for Golden State Water Company.
- Golden State Water Company. 2005o. *2005 Urban Water Management Plan – Simi Valley. Final Report.* Rancho Cordova, CA. Prepared by CH2MHILL for Golden State Water Company.
- Golden State Water Company. 2005p. *2005 Urban Water Management Plan – South Arcadia. Final Report.* Ontario, CA. Prepared by CH2MHILL for Golden State Water Company.
- Golden State Water Company. 2005q. *2005 Urban Water Management Plan – South San Gabriel. Final Report.* Ontario, CA. Prepared by CH2MHILL for Golden State Water Company.
- Golden State Water Company. 2005r. *2005 Urban Water Management Plan – Southwest. Final Report.* Anaheim, CA. Prepared by CH2MHILL for Golden State Water Company.
- Golden State Water Company. 2005s. *2005 Urban Water Management Plan – West Orange. Final Report.* Ontario, CA. Prepared by CH2MHILL for Golden State Water Company.
- Metropolitan Water District of Southern California. 2005. *The Metropolitan Water District of Southern California – Regional Urban Water Management Plan*. Los Angeles, CA.

- Poso Creek Regional Management Group. 2007. *Poso Creek Integrated Regional Water Management Plan.* Wasco, CA. Prepared by GEI Consultants for Semitropic Water Storage District.

The 2001 FEIS concluded that the project may induce growth in areas south of the Sacramento-San Joaquin Delta (Delta), resulting in secondary environmental effects. This could occur in one of two ways:

- the project could add water directly for export to municipal water supplies or agricultural production that may support growth; or

- project water could be used to meet water quality or environmental requirements as a substitute for other water that could be used to support growth.

However, because no specific end users of project water were identified, the 2001 FEIS was unable to disclose where growth-inducing effects of the project could occur.

Since the 2001 FEIS was completed, additional limitations have been placed on Central Valley Project (CVP) and State Water Project (SWP) operations based on Endangered Species Act (ESA) compliance with the coordinated operations of the SWP and CVP (see Section 3.4, "Aquatic Resources, Including Wetlands"). These restrictions have limited water deliveries south of the Delta in recent years. Metropolitan also has entitlements to water from the Colorado River that have been reduced in recent years because of regulatory and climatic factors. However, changes in SWP, CVP, and Colorado River water delivery operations related to these new circumstances do not affect the growth analysis in this chapter.

Now that places of use for project water have been identified, specific locations where growth may occur have been disclosed (see Tables 2-2, 2-3, and 4-1), as have the types of growth that are anticipated in those areas (see Table 4-1). Relevant planning agencies in these areas have developed "growth management plans" that address the specific amount and location of growth, as well as possible environmental effects associated with this growth. The analysis in this SDEIS focuses on determining how the project could contribute to growth in the places of use, and on identification and disclosure of the types of indirect effects that could result from this growth.

NO-ACTION ALTERNATIVE

The No-Action Alternative was not analyzed for growth-inducement in the 2001 FEIS, for the same reasons that it is not evaluated for growth-inducement herein. Under the No-Action Alternative, no water would be supplied to any users outside of the project islands; therefore, the No-Action Alternative would not be growth-inducing and no related indirect environmental effects would occur.

ALTERNATIVES 1, 2 (PROPOSED ACTION), AND 3

Alternatives 1, 2, and 3 involve storage of water on project islands and delivery of that water south through the CVP or SWP conveyance facilities to urban and agricultural users in the identified places of use during years when there is unmet demand, and to the Semitropic Groundwater Bank and Antelope Valley Water Bank for banking during years when there is not unmet demand. One of the project goals is to improve the reliability of water delivery to the places of use, thereby helping to meet demand created by reductions in CVP, SWP, and Colorado River water supply. Although there are many obstacles related to growth in these areas that go beyond the jurisdiction of the lead agency for this project (USACE), an improvement in water supply reliability could remove a major obstacle to growth in the places of use.

Improved water supply reliability in the places of use could allow planned development to go forward that otherwise may have been hindered by a lack of reliable water supplies. As shown in Table 4-1, relevant planning documents anticipate growth in all of the places of use, and the improved water supply reliability provided by the project, could accommodate a portion of this growth. Types of growth anticipated at the places of use consist of population growth and housing development, commercial and industrial development, and expansion of areas under agricultural cultivation.

The indirect effects that could result from urban growth and increased crop cultivation in the identified places of use would vary depending on site-specific conditions. Although it is not possible to quantify specifics related to how and where the proposed project would result in growth and what indirect environmental effects would occur from that growth, housing growth and commercial and industrial development in general could result in the following types of indirect environmental effects:

- loss of vegetation and wildlife habitat and related effects on plant communities and wildlife, including Threatened and Endangered species;
- decreased air quality caused by automobile emissions and industrial pollutants;
- reduced water quality caused by increased urban runoff and industrial discharges;
- destruction of cultural and historical resources located at development sites;
- conversion of prime and productive agricultural lands to nonagricultural uses, and related losses of agricultural employment;
- increased demand for government services, including educational services and police and fire protection services; and
- increased need for public infrastructure, including wastewater treatment facilities, parks, and roadways.

Additionally, if new water sources were used to bring existing fallow or natural lands into production, irrigating and cultivating more farmland could result in similar types of indirect effects, including:

- the loss of natural vegetation and wildlife habitat and related effects on plant communities and wildlife, including Threatened and Endangered species;
- decreased air quality resulting from generation of dust and applications of pesticides; and
- reduced water quality caused by agricultural runoff to streams and rivers, and related effects on fish species and habitat.

The environmental documentation prepared by local, state, and Federal agencies that approve and provide permits for this growth (e.g., residential, commercial, and industrial projects) would identify the site- and issue-specific environmental effects. Public involvement and agency consultation would occur during the environmental documentation process for site-specific projects. As part of the environmental process required by NEPA and the California Environmental Quality Act (CEQA), the significant indirect effects of this growth would be identified and mitigation of effects would be adopted and implemented if available and feasible. The responsibility for implementing and monitoring mitigation measures would lie with the specific local, state, or Federal agencies with discretionary authority over the projects. Some projects may result in effects that cannot be mitigated or reduced to less-than-significant levels; in such cases, growth inducement associated with this growth could result in residual significant effects.

4.1.3 Summary of Growth-Inducing Effects

In summary, the additional water supply provided by the project may remove an obstacle to a portion of the planned growth in the identified places of use, which may result in indirect environmental effects. More farmland could be brought into production as a result of project implementation. As stated previously, the environmental documentation prepared by local, state, and Federal agencies that approve and provide permits for residential, commercial, and industrial projects in the places of use would identify site- and resource-specific indirect effects of this growth. Mitigation measures implemented by agencies with jurisdiction over urban development projects would address many of the indirect effects of this growth.

Although it would be too speculative to quantify the site- and resource-specific indirect effects of growth in the places of use identified, it is reasonable to conclude that feasible mitigation may not always be available to reduce every effect to a less-than-significant level. Although the project could remove an obstacle to growth and therefore could contribute to indirect effects related to this growth, neither the lead agency nor the project applicant has the jurisdiction to provide a framework for mitigation of the as-yet-undetermined specific indirect effects of this growth.

4.2 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

NEPA requires that an environmental analysis include identification of "…any irreversible and irretrievable commitment of resources which would be involved in the proposed action should it be implemented." (Section 102 [42 United States Code Section 4332(c)].) Irreversible and irretrievable resource commitments are related to the use of nonrenewable resources and the effects that this use could have on future generations. Irreversible effects result primarily from the use or destruction of a specific resource (e.g., energy and minerals) that cannot be replaced within a reasonable time frame. Irretrievable resource commitments involve the loss in value of an affected resource that cannot be restored as a result of the action (e.g., extinction of a threatened or endangered species or the disturbance of a cultural resource).

Irretrievable commitment of resources would occur as a result of project implementation. The resources that would be irretrievably committed are associated with construction, operation, and maintenance of the project facilities and consist of building materials, fossil fuels and other energy resources, and loss of cultural resources. The project would entail conversion of land from its present agricultural uses to water storage or habitat preservation, which also has effects on wetlands and wildlife species. However, most of the land converted for water storage and wetland and wildlife habitat creation could physically be converted back to existing agricultural land uses, although project permit conditions would make this unlikely.

4.3 RELATIONSHIP BETWEEN SHORT-TERM USE OF THE ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

Effects on resources are often characterized as being temporary and short-term or long-term in duration. Effects that occur only during construction are considered temporary. Effects that occur over a period of 3 years or less result from short-term uses of the resources in an area most often associated with construction and up to 3 years after construction ceases. Construction can create temporary water quality effects and increases in noise, air quality, greenhouse gas emissions, and traffic that can disturb resources in an area but subside when the work is complete. Long-term effects relate to the maintenance and enhancement of long-term productivity—in particular, the consistency of the project with long-term economic, social, regional, and local planning objectives. These effects may lead to permanent loss or degradation of resources. The short- and long-term effects of the project under consideration are summarized below.

4.3.1 SHORT-TERM USES

Implementation of Alternatives 1, 2 (Proposed Action), or 3 would result in temporary and short-term construction-related effects. As discussed elsewhere in this SEIS, the temporary and short-term construction effects would be associated predominantly with water quality, traffic, air quality, and greenhouse gas emissions.

The project applicant would implement mitigation measures identified in each topical section to reduce these effects to a less-than-significant level wherever feasible and available.

4.3.2 LONG-TERM USES

Implementation of Alternatives 1, 2 (Proposed Action), or 3 would result in long-term effects related to the loss of biological resources and habitat; a change in the visual character and quality of the project islands; air quality emissions; greenhouse gas emissions; increased roadway and boat traffic; and loss of use of agricultural land on the four project islands during the 50-year project lifespan. Long-term benefits and increases in productivity from implementation of the project are described below.

- The availability of high-quality water in the Delta for export or outflow would be increased.
- Supplemental water storage would be provided in the Semitropic Groundwater Storage Bank and the Antelope Valley Water Bank south of the Delta.
- Water supply would be provided for agricultural, domestic, and municipal and industrial uses for designated south-of-Delta users.
- The sustainability of agriculture would be enhanced within the places of use of water supplied by the project (particularly in the Semitropic Water Storage District, which provides water for irrigation of over 140,000 acres of agricultural land in Kern County).
- Water would be released for water quality enhancement in the Bay-Delta Estuary in the fall as an additional beneficial water use in a designated place of use.
- Alternatives 1 and 2 would compensate for wetland and wildlife effects of the water storage operations on the Reservoir Islands by implementing the proposed Compensatory Mitigation Plan (CMP) on two Habitat Islands (Bouldin Island and Holland Tract).
- Agricultural production on project islands used for water storage purposes would be restored at the end of the projected 50-year lifespan of the project.

4.4 SIGNIFICANT AND UNAVOIDABLE ADVERSE EFFECTS

Chapter 3 of this SEIS provides a detailed analysis of all significant and potentially significant environmental effects related to implementing the project; identifies feasible mitigation measures, where available and practicable, that could avoid or reduce these significant and potentially significant effects; and presents a determination whether these mitigation measures would fully reduce these effects to less-than-significant levels. In addition, each resource section identifies the significant cumulative effects resulting from the combined effects of the project and related projects. If a specific effect cannot be fully reduced to a less-than-significant level, it is considered a significant and unavoidable adverse effect.

Project implementation would result in significant and unavoidable adverse effects after mitigation implementation in several environmental issue areas, as shown in Table 4-2 and discussed in detail below. The detailed discussion of specific significant and unavoidable effects that is presented below follows the issue areas and effects of the SEIS that are identified in Table 4-2. If no significant and unavoidable effects would occur, that topic or that portion of the SEIS is not discussed below. Significant and unavoidable cumulative effects are listed below in Subsection 4.4.10.

Table 4-2
Summary of Project-Related Significant and Unavoidable Effects

Section Number/Issue Area	Effect Number	Effect Title
3.1 Aesthetics	VIS-3	Reduction in the Quality of Views of Bacon Island and Webb Tract from Adjacent Waterways and from the Santa Fe Railways Amtrak Line
	VIS-5	Reduction in the Quality of Views of the Habitat Islands from Adjacent Waterways (Alternative 3 Only)
3.2 Agricultural Resources	AG-2	Conversion of Prime Farmland and Other Agricultural Land to Nonfarm Uses
3.3 Air Quality	AIR-3	Increase in ROG Emissions on the Project Islands during Construction
	AIR-5	Increase in NO_X Emissions on the Project Islands during Construction
3.4 Aquatic Resources	AQR-5	Effects on Juvenile Chinook Salmon from Diversions and Releases
	AQR-6	Effects on Juvenile Steelhead from Diversions and Releases
	AQR-7	Effects on Delta Smelt from Diversions and Releases
	AQR-8	Effects on Longfin Smelt from Diversions and Releases
	AQR-9	Effects on Green Sturgeon from Diversions and Releases
3.7 Cultural Resources	CUL-1	Destruction of Historic Buildings and Structures on Bacon Island and Bouldin Island
	CUL-2	Destruction of Levees and Unevaluated Built Environment Resources
	CUL-4	Disturbance to Human Remains as a Result of Compaction, Inundation, Wave-Induced Erosion, Habitat Development and Management, or Vandalism (Alternative 3 Only)
3.8 Environmental Justice	EJ-3	Potential for Disproportionately High and Adverse Effects on Minority and Low-Income Populations in CTs 39 and 40.01 and the Thornton Island CDP (Cultural Resources and Socioeconomics)
3.12 Land Use	LU-4	Consistency with Zoning and General Plan Designations and Delta Protection Commission Land Use Plan Principles
3.16 Socioeconomics	SOCIO-4	Permanent Effects on Employment and Personal Income Resulting from Operation and Maintenance of Water Storage Facilities
	SOCIO-7	Permanent Effects on Agricultural Economics from Idling of Crops on the Project Islands
3.17 Traffic and Transportation	TRA-8	Fog Hazard for Roadway Traffic on SR 12 (Alternative 3 Only)
3.19 Water Supply	WS-1	Change in Delta Consumptive Use (Alternative 3 Only)

Source: Data compiled by AECOM in 2014

4.4.1 AESTHETICS

As discussed in Section 3.1, "Aesthetics," implementing Alternatives 1, 2, or 3 could reduce the vividness, intactness, and visual quality of interior and exterior project island views by converting agricultural use to open water or shallow-water wetland vegetation; removing vegetation along project levees; and introducing rock revetment, pump stations, and siphon stations. Views from the Santa Fe Railways Amtrak line along the south side of Bacon Island would be similarly affected (Effect VIS-3). Constructing the water storage facilities and associated maintenance boat docks would reduce the unity and intactness of the highly sensitive views from adjacent channels by introducing built elements into a generally intact landscape (Effect VIS-5). Mitigation Measure VIS-MM-1 would require screening consisting of native trees, shrubs, landscape berms, and ground covers between the project facilities and designated scenic waterways and Mitigation Measure VIS-MM-2 would require that pump and siphon station structures blend in with the surrounding environment through the use of earth-toned paint and construction materials with subdued, earth-tone colors; limit structure heights; and emphasize horizontal features. Implementing Mitigation Measures VIS-MM-1 and VIS-MM-2 would reduce the severity of these effects, but not to a less-than-significant level. Therefore, Effects VIS-3 and VIS-5 are considered significant and unavoidable.

4.4.2 AGRICULTURAL RESOURCES

As discussed in Section 3.2, "Agricultural Resources," implementing Alternatives 1 and 2 would convert an estimated 14,824 acres of Important Farmland to nonagricultural uses on the four project islands (Effect AG-2). Implementation of Alternatives 1 and 2 would also result in the loss of agricultural productivity on Bouldin Island, although agricultural conservation easements would be placed on Bouldin Island and Holland Tract as part of the proposed CMP. Implementing Alternative 3 would convert an additional approximately 10,006 acres of Important Farmland on Bouldin Island and Holland Tracts to water storage use. In total, Alternative 3 would convert an estimated 15,337 acres of land designated as Important Farmland (Effect AG-2). The effect of converting Important Farmland and resulting losses in agricultural production would be attenuated by some of the project features and actions, including enhancing the sustainability of agriculture within the place of use of water supplied by the project, contributing to the sustainability of in-Delta agriculture by providing additional water supply, and restoring the project islands to agricultural uses at the end of the project. Implementing Mitigation Measure AG-MM-1 would require Delta Wetlands to provide Semitropic Water Storage District $500,000 over each of the first 10 years of project operations, for a total of $5,000,000. The funding is intended to further Semitropic's goals of sustaining agriculture through the provision of agricultural surface water to farmers within its boundaries at least cost and provide long-term reliability. Although implementing AG-MM-1 would help to reduce the level of this effect, no feasible mitigation is available to fully reduce this effect to a less-than-significant level. Restoring project lands to agricultural uses at the conclusion of the project would ensure that permanent conversion of agricultural land and production could be avoided; however, it would not reduce the long-term conversion of important farmlands during the 50-year life of the project. Therefore, the direct conversion of agricultural land under Effect AG-2 is considered a significant and unavoidable effect.

4.4.3 AIR QUALITY

As discussed in Section 3.3, "Air Quality," the project's construction-related activities under Alternatives 1, 2, or 3 could generate emissions of reactive organic gasses (ROG) and nitrogen oxides (NO_X) that exceed the San Joaquin Valley Air Pollution Control District's (SJVAPCD) applicable mass emission thresholds (Effects AIR-3 and AIR-5). Implementing Mitigation Measures AIR-MM-1, AIR-MM-2, and AIR-MM-3 would reduce temporary and short-term construction-related air quality effects by requiring routine maintenance of earthmoving equipment as well as all other construction and transport vehicles; obtaining borrow material from appropriate sites located closest to intended fill locations, which would reduce the overall amount of equipment and vehicle operation; and prohibiting construction equipment or other vehicle engines idling when not in use to reduce the amount of engine exhaust. Implementation of Mitigation Measures AIR-MM-1, AIR-MM-2, and AIR-MM-3 would reduce the adverse effects associated with construction-related generation of ROG and NO_X emissions, but not to a less-than-significant level. Therefore, Effects AIR-3 and AIR-5 are considered significant and unavoidable.

4.4.4 AQUATIC RESOURCES

As discussed in Section 3.4, “Aquatic Resources” under Effect AQR-5, the average entrainment loss of Chinook salmon to the project diversions was estimated to range from 0.0% of the baseline State Water Project/Central Valley Project (SWP/CVP) loss for spring-run Chinook salmon (which were present only at very low density during the December–March diversion period) to 0.2% of baseline for winter-run and late fall–run Chinook salmon (which are most abundant during the December–March diversion period). Reduction and screening of existing agricultural diversions would offset the project losses for fall-run and spring-run Chinook salmon, but not for winter-run or late fall-run Chinook salmon because the main migration periods of the former two species overlap the main diversion period to a lesser extent than those of the latter two species. In addition, there is the potential for project diversions to provide false outmigration cues to Chinook salmon juveniles traversing the Delta via the central Delta. Due to direct entrainment and increased residence time within the central Delta (leading to a greater risk of predation, prolonged effects of poor water quality, and a greater possibility of entrainment at the south Delta pumps), the project was estimated to result in average mortality of 0.12% of winter-run Chinook salmon juveniles and 0.01% of spring-run Chinook salmon. Implementing Mitigation Measures AQR-MM-1, AQR-MM-5, and AQR-MM-6 would require conservation of shallow-water vegetated habitat; would establish a fishery improvement mitigation fund that would provide monetary compensation to support habitat enhancement and conservation of fish populations; and would establish a perpetual easement for conservation of 200 acres of shallow-water aquatic habitat on Chipps Island. However, these mitigation measures would not fully compensate for the potential loss of individuals that could occur because the loss of individuals may represent a substantial loss to the overall population in terms of genetically fitter individuals that have survived passage to the Delta and may substantially reduce the abundance of this species. Therefore, effect AQR-5 is considered significant and unavoidable.

As discussed under effect AQR-6, all of potential project-related effects identified above could also affect steelhead: changes in water quality due to project discharges; entrainment at project diversions and, to a lesser extent, during export of discharged project water; and increased Delta mortality because of altered hydrodynamics or false outmigration cues caused by project diversions. The overall loss of steelhead smolts entering the Delta from the Sacramento River that might be attributable to project operations (i.e., direct entrainment, increased predation loss, increased exposure to poor water quality, and increased probability of entrainment at SWP/CVP) was estimated at approximately 0.7%. This would represent approximately 14,000 smolts (hatchery- and wild-origin). Implementing Mitigation Measures AQR-MM-1, AQR-MM-5, and AQR-MM-6 would require conservation of shallow-water vegetated habitat; would establish a fishery improvement mitigation fund that would provide monetary compensation to support habitat enhancement and conservation of fish populations; and would establish a perpetual easement for conservation of 200 acres of shallow-water aquatic habitat on Chipps Island. However, these mitigation measures would not fully compensate for the potential loss of individuals that could occur because the loss of individuals may represent a substantial loss to the overall population in terms of genetically fitter individuals that have survived passage to the Delta and may substantially reduce the abundance of this species. Therefore, effect AQR-6 is considered significant and unavoidable.

As discussed under Effect AQR-7, the estimated average annual loss of Delta smelt that would be attributable to the project is approximately 0.72% of the adult population. This may represent approximately 6,500 adult delta smelt. Implementing Mitigation Measures AQR-MM-1, AQR-MM-5, and AQR-MM-6 described above would help to reduce the level of this adverse effect. In addition, implementing Mitigation AQR-MM-2 would require that project facilities be sited to avoid existing shallow water vegetated habitat; AQR-MM-3 would limit waterside construction to less sensitive time periods; and AQR-MM-4 would require best management practices to be implemented for waterside construction. However, because of the current low abundance of delta smelt and the uncertainty associated with the effectiveness of the proposed mitigation, Effect AQR-7 is considered significant and unavoidable.

As discussed under Effect AQR-8, the project on average would result in a reduction of the abundance of longfin smelt by approximately 1%. The average annual loss of longfin smelt subadults in the fall midwater trawl index area attributable to the project's water diversions during the early-life period is estimated to be approximately 1,300 fish. Implementing Mitigation Measures AQR-MM-1, AQR-MM-5, and AQR-MM-6 described above would help to reduce the level of this adverse effect. In addition, implementing Mitigation AQR-MM-2 would require that project facilities be sited to avoid existing shallow water vegetated habitat; AQR-MM-3 would limit waterside construction to less sensitive time periods; and AQR-MM-4 would require best management practices to be implemented for waterside construction. However, because of the uncertainty associated with the effectiveness of the proposed mitigation, Effect AQR-8 is considered significant and unavoidable.

As discussed under Effect AQR-9, juvenile green sturgeon may be entrained at the SWP/CVP pumping facilities during export of discharged project water. The average annual net increase in loss was 2.6% of baseline SWP/CVP losses; this amounted to five green sturgeon based on the extrapolation of observed salvage density that was used to derive the density of green sturgeon in the Delta. Although the estimated average loss appears small and the maximum loss was estimated at 19, the declining population abundance may make even a small loss substantial and reduce the population towards levels that are no longer self-sustaining. Implementing Mitigation Measure AQR-MM-5 would establish a fishery improvement mitigation fund that would provide monetary compensation to support habitat enhancement and conservation of fish populations. However, implementation of this mitigation would not reduce this adverse effect to a less-than-significant level because the declining population abundance may make even a small loss substantial and reduce the population towards levels that are no longer self-sustaining. Therefore, Effect AQR-9 is considered significant and unavoidable.

4.4.5 CULTURAL RESOURCES

As discussed in Section 3.7, "Cultural Resources" under Effect CUL-1, the majority of the buildings contributing to the eligibility of the Bacon Island Rural Historic District would be adversely affected by reconstruction of the levees and inundation because all buildings are planned for demolition under Alternatives 1, 2, and 3. Most of the structures, as well as the Mokelumne River Swing Truss Bridge, lie on the perimeters of the islands in areas that would be disturbed by reconstruction of levees. Implementing Mitigation Measures CUL-MM-1, CUL-MM-1a, CUL-MM-1b, CUL-MM-1c, and CUL-MM-1d would reduce these adverse effects, but not to a less-than-significant level because project implementation would still result in the damage or destruction of NRHP-eligible properties. Therefore, Effect CUL-1 is considered significant and unavoidable.

In addition, levees and unevaluated built environment resources within the APE would be adversely affected by the reconstruction of levees and inundation if the resources are determined to be NRHP-eligible (Effect CUL-2). The eligible resources would be damaged or destroyed by implementation of Alternatives 1, 2, or 3 and the physical characteristics that convey their significance would be altered. Implementing Mitigation Measures CUL-MM-1, CUL-MM-1a, CUL-MM-1c, CUL-MM-1d, and CUL-MM-2 would reduce these adverse effects, but not a less-than-significant level because project implementation would still result in the damage or destruction of NRHP-eligible properties. Therefore, Effect CUL-2 is considered significant and unavoidable.
As discussed in Effect CUL-4, project implementation could also result in the disturbance of human burials. Under Alternative 3, all four islands would be used for water storage, and earth-moving activities on the four islands have a potential to encounter previously unknown human remains in any location, particularly areas associated with Piper sand mounds. Implementing Mitigation Measures CUL-MM-1b, CUL-MM-1e, CUL-MM-1g, and CUL-MM-1h would reduce this adverse effect, but not to a less-than-significant level because the level of potential ground disturbance under Alternative 3 (i.e., all four project islands) would be great enough that previously undiscovered burials could be uncovered. Therefore, Effect CUL-4 (under Alternative 3) is considered significant and unavoidable.

4.4.6 LAND USE

As discussed in Section 3.12, "Land Use" the proposed water storage and habitat management plan on the four project islands would be consistent with existing land use and zoning designations in San Joaquin and Contra Costa Counties. However, because use of the project islands would remove agricultural production during the projected 50-year lifespan of the project, the project would be inconsistent with Contra Costa County and Delta Protection Commission principles to protect and encourage agricultural uses in the Delta (Effect LU-4). As described in Chapter 2, "Project Description and Alternatives," the project applicant has entered into an environmental commitment to place agricultural conservation easements on Bouldin Island and Holland Tract, which would help to reduce the level of this effect. However, there are no feasible mitigation measures available to fully reduce this effect to a less-than-significant level. Therefore, Effect LU-4 is considered significant and unavoidable.

4.4.7 SOCIOECONOMICS

As discussed in Section 3.16, "Socioeconomics," implementing Alternatives 1 or 2 would result in the loss of an estimated 99 jobs and $2.7 million in personal income currently generated by agricultural operations (Effect SOCIO-4). Implementing either of these alternatives would also generate approximately 222 permanent jobs and a projected $12.1 million in annual, permanent income from operation and maintenance of water storage facilities. Alternative 3 would result in the loss of an estimated 192 jobs and $5.2 million in personal income currently generated by agricultural operations, which would be partially offset by the generation of an estimated 258 permanent jobs and a projected $14.1 million in annual, permanent income from operation and maintenance of water storage facilities. While a net increase in employment would result from operation and maintenance of water storage facilities under all three alternatives, it cannot be assumed that these jobs would be filled by displaced agricultural workers because the skills required may not comparable. No feasible mitigation measures are available to reduce the level of this effect. Therefore, the loss of jobs and personal income to farmworkers and other workers in agriculture-related industries (Effect SOCIO-4) is considered a significant and unavoidable effect.

As described in Effect SOCIO-7, implementing Alternatives 1 and 2 would result in the loss of approximately 14,805 acres of crops, $17.4 million in production value, and $8.0 million in value added. Implementing Alternative 3 would result in in a loss of approximately 17,761 acres of crops, $18.8 million in production value, and $9.0 million in value added. The effect of losses in agricultural production in Contra Costa and San Joaquin Counties would be attenuated by some of the project features and actions, such as restoring agricultural production after the project is over, and enhancing the stability of the project levees (which would help benefit agriculture by reducing the threat of levee failure on the habitat islands and other islands within the Delta that also support agriculture). However, despite these project-related benefits which would somewhat offset the adverse effects of agricultural land conversion, the permanent effect on agricultural economics from idling of crops on the project islands constitutes a significant socioeconomics effect. Implementation of the project features and actions described above would ensure that permanent conversion of agricultural land and production could be avoided; however, it would not reduce the long-term loss of crop acreage, crop production values, and value added during the 50-year life of the project, and no feasible mitigation measures are available to reduce the level of this adverse effect. Therefore, the economic effects from idling of crops on the project islands (Effect SOCIO-7) are significant and unavoidable.

4.4.8 TRAFFIC AND TRANSPORTATION

As discussed in Section 3.17, "Traffic and Transportation," implementing Alternative 3 could increase the amount of fog produced along State Route 12 on Bouldin Island by increasing the water surface area adjacent to the roadway, thereby resulting in increased traffic hazards (Effect TRA-8). There are no feasible mitigation measures available to reduce this effect to a less-than-significant level; therefore, Effect TRA-8 is considered significant and unavoidable.

4.4.9 WATER SUPPLY

As discussed in Section 3.19, “Water Supply” conversion of the project islands from agriculture to water storage and wildlife habitat management would increase the Delta consumptive use of water from evaporation and/or crop transpiration. Total consumptive use under Alternative 3 is estimated to average 54,000 acre-feet per year (taf/yr), which is approximately 10 taf/yr greater than under the No-Action Alternative (Effect WS-1). This increase in Delta consumptive use represents about a 1% increase in Delta lowland consumptive use. Daily accounting of project operations would be required under the protest dismissal agreements, which define how the project would be operated independent of, and in a manner that does not adversely affect, the CVP/SWP Delta operations; however, the increase in project-related consumptive use would be significant, and there are no feasible mitigation measures available to reduce this adverse effect to a less-than-significant level. Therefore, Effect WS-1 is considered significant and unavoidable.

4.4.10 CUMULATIVELY CONSIDERABLE EFFECTS

As discussed in detail in each resource section of Chapter 3, project implementation would result in direct and indirect cumulatively considerable incremental contributions to significant adverse cumulative effects. Those effects are listed below.

AESTHETICS

- Reduction in the Quality of Views of the Reservoir Islands

AGRICULTURAL RESOURCES

- Conversion of Prime Farmland and Other Agricultural Land to Nonfarm Uses

AIR QUALITY

- Increase in Cumulative Production of Ozone Precursors and Carbon Monoxide in the Delta

AQUATIC RESOURCES

- Cumulative Effects on Listed Fish Species

CULTURAL RESOURCES

- Destruction of or Damage to NRHP-Eligible Properties and Historic Districts

ENVIRONMENTAL JUSTICE

- Potential for Disproportionately High and Adverse Effects on Minority and Low-Income Populations in CTs 39 and 40.01 and the Thornton Island CDP (Cultural Resources and Socioeconomics)

HAZARDOUS WASTE AND MATERIALS

- Increase in Mosquito Abatement Needs

LAND USE

- Consistency with Zoning and General Plan Designations and Delta Protection Commission Land Use Plan Principles

SOCIOECONOMICS

- Permanent Effects on Employment and Personal Income Resulting from Operation and Maintenance of Water Storage Facilities
- Permanent Effects on Agricultural Economics from Idling of Crops on the Project Islands

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